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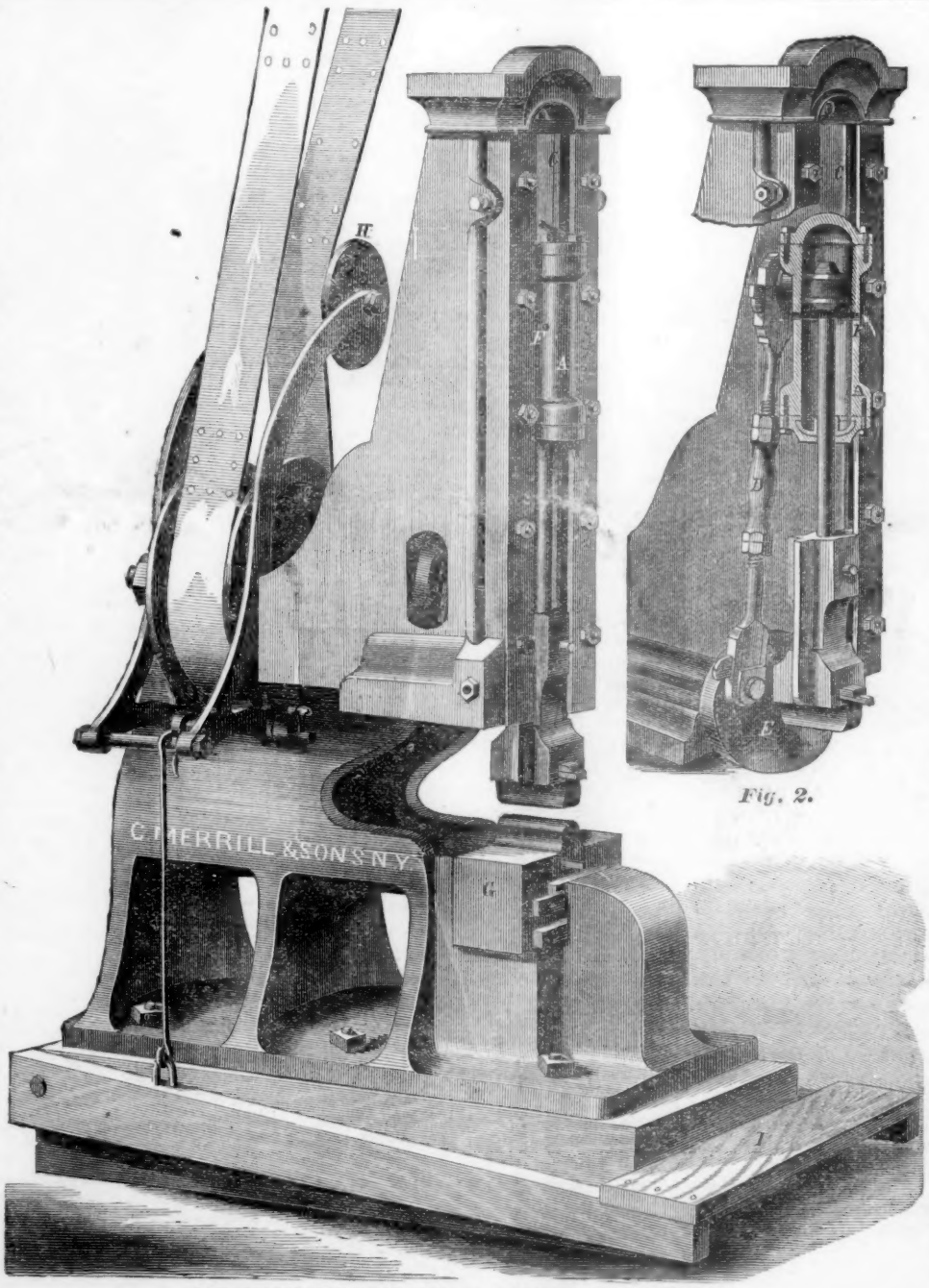
Hotchkiss Patent Forge Hammer.

Since steam power has taken the place of manual labor so largely in most of our arts and manufactures, there is, perhaps, no place where its great value is more fully displayed than in the various mechanical appliances and machinery employed to forge, swage, weld, and fashion iron into the multifarious forms required in the mechanical and other arts.

The steam forge hammer has worked wonderful changes in the manner and cost of iron manufacture itself, inasmuch as it has shortened the process of purifying the iron and bringing it to a proper condition by the system of forging the "blooms," as they are called, with immense steam hammers. These hammers are a great improvement over the old fashioned trip or tilting hammer, with its cumbrous machinery and noisy jar and clatter.

The Hotchkiss hammer operates somewhat similarly to the steam hammer and trip hammer combined, using an air piston instead of steam, which also takes the place of the cam of the trip hammer, making a far superior hammer to either.

The engravings shown herewith, will give a clear idea of its operation. It has the following claims to excellence, viz.: simplicity and durability, economy of power and space, and for striking square with a sharp and elastic blow. It runs with little noise, and by the peculiar arrangement of the cylinder and piston, the hammer is driven by air springs, which saves the machine from jar, other than the blow on the anvil or works, and it can be used in any building without injuring the foundation or walls.



HOTCHKISS PATENT FORGE HAMMER.

The cylinder and hammer moving in vertical slides, each blow is square, exactly in the same place, and some kinds of die work can be forged as exactly as under a drop, with greater rapidity; it is under the perfect control of the operator, can strike light or heavy, and give any number of blows in quick succession.

Fig. 2.

It will draw, weld or swage in the most perfect manner, and requires less power than any other hammer giving the same blow. The working parts are simple, not liable to get out of order, and are carried in a strong iron frame.

The hammer derives the increased force of its blow from the reaction of compressed air upon the piston. The air is compressed within a cylinder, A, by the piston, B, which fits the cylinder air-tight (see fig. 2). The cylinder moves in the slides, C, by the action of the connecting rod, D, driven by the face plate, E, by belting in the usual manner. The cylinder is air-tight at each end; there are two small holes, F, in the cylinder, through which the air passes freely in and out, which supplies any leakage and prevents a vacuum behind the piston as it passes beyond the air ports either way.

It will be noticed that the *piston, piston-rod* and *hammer* are *entirely independent* of the cylinder, and can be moved up and down *without moving* the cylinder; also, that when the cylinder is moved either way, the piston passes the air ports, F, confining the air in either end of the cylinder, which prevents the piston striking either head, and acts as a spring, lifting the hammer up, or accelerating its downward movement. The cylinder has a definite motion, governed by the travel of the crank, but the hammer has more lift owing to the compression of the air.

If the cylinder is moved up and down slowly there is no blow given, as the weight of the hammer rests on the cushion of air, *under the piston* in the *bottom* of the cylinder. If the cylinder is moved up quickly, the air under the piston strikes and lifts the hammer as quickly

and the momentum of the hammer in its upward motion causes the piston to pass the air ports, F, and compresses the air, more or less, according to the speed, in the *upper* part of the cylinder; the elasticity of which acting as a spring, accelerates the downward motion of the hammer, to which may be added the rapid downward motion of the cylinder following up, and crowding the air spring upon the piston, adding to the force of the blow; thus, by a rapid reciprocating motion of the cylinder, quick and sharp blows are given.

The anvil block, G, can be removed and the hammer run: then the cushion of air in the bottom of the cylinder receives the entire blow: if the block is replaced, the anvil or work receives the blow instead of the air-cushion.

The blow can be controlled by the speed; the sharpest blow is given when run at high speed. To run rapid and light, raise the cylinder by lengthening the rod, which allows the bottom cushion to receive the bulk of the blow.

The dies are fitted in with keys, and the anvil block is secured by another key, so that the dies can be set properly without delay.

The speed of the hammer is regulated by the idler pulley, H, operated by the treadle, I.

The action of the hammer is peculiar; It may be compared to a weight vibrated between air-springs and hould any slight leakage of air occur, it is renewable through the air-ports in centre of cylinder at every movement of the piston.

In practical operation the hammer is lifted by the lower air-cusbion lifting the piston, when the cylinder is lifted by the rotating crank. If the cylinder is raised quickly, and when the cylinder has arrived at its highest point, the hammer, rod and piston have acquired a momentum which causes the piston to rise higher, and passing the air-ports, confines the air closely in the upper portion of the cylinder, the elasticity of which reacts upon the piston, driving it down.

In addition to this force, the crank brings the cylinder down with speed, forcing the upper cushion upon the piston which, together with the reaction of the compressed air, drives the hammer down with great velocity. When run slow, the blow is correspondingly light. The hammer, after being driven down, is instantly picked up by the ascending air-cushion without any shock or jar, and so long as the packings are tight, it can be run for years with little wear. These packings are simple as a pump-packing, durable and easily renewed.

These hammers have been in use by the public during the past two and a half years, with great success. It is said they will do double the work with one half the power compared with the ordinary tilt or trip hammers, while the cost of repairs and consequent loss of time are very much less.

Messrs. Charles Merrill & Sons, 556 Grand street New York, manufacture these hammers. Parties can apply to them for further information, or by calling can see them in practical operation.

A Life-Saving Mattress.—Experiments were made on the 12th of Aug. at Long Branch, by a party from New York, with the view of testing Golding's Life-Saving Mattrass. The mattrasses in question are intended to take the place of ordinary mattresses on board vessels. The lower portion is composed of cork cuttings encased in canvass, while on top is a second mattress of hair—the whole intended to serve the double purpose of a bed and life preserver. Thus, if a passenger is awakened in the night and finds the vessel sinking he has only to pick up the mattrass and jump into the water in order to be safe. The steamer Silas O. Pierce, having the party on board, arrived within half a mile of the shore, when five men, each having a mattress, jumped off from the vessel. The beds proved to be exceedingly buoyant, and the men sat on them and paddled themselves ashore by using their hands as paddles. A number of gentlemen connected with the ocean and river steamship companies were present, and at a meeting held on board, expressed their opinion that the apparatus was the most admirable life saving machine that had yet been presented to the public. In the cork casing are several compartments in which water and provisions may be kept.

Chemistry, as Applied to the Manufacture of Coal Gas.

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REVISED AND EXTENDED FOR THE FOURTH EDITION,
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[From "Clegg on the Manufacture of Coal Gas."]

Water.—We have already stated that water is composed of two volumes of hydrogen and one of oxygen, or two parts by weight of hydrogen and sixteen parts of oxygen. Oxygen and hydrogen, though mixed in the proper proportions for producing water, do not unite until the temperature of a portion of the mixture has been raised to redness; they then unite with a loud explosion. When brought together gradually and inflamed, as when a jet of oxygen is admitted into a jar of hydrogen, or *vice versa*, they burn quietly.

The general properties of water are too well known to require description. It is always produced when coal is decomposed by heat. This arises from the presence of hygrometric water in the coals, and from its elements forming a part of their composition. The former portion is the first product which passes from the retorts; the second only comes over when the actual decomposition of the coal has commenced. This water is condensed and carried into the tar-well, where it holds in solution many of the more soluble products of the distillation, for, besides its well-known solvent action upon solids, water possesses the property of absorbing or dissolving gases; and a knowledge of its relative solvent action upon the various gases is of great importance to the gas manufacturer.

The following table exhibits the number of volumes of various gases which 100 volumes of water, at 60° Fahr. and 30 inches barometric pressure, can absorb:

Ammonia	7800	volumes.
Sulphurous Acid	3300	"
Sulphuretted Hydrogen	253	"
Carbonic Acid	100	"
Olefiant Gas	12·5	"
Illuminating Hydrocarbons	Not determined, but probably more soluble than olefiant gas.	
Oxygen	3·7	"
Carbonic Oxide	1·56	"
Nitrogen	1·56	"
Hydrogen	1·56	"
Light Carburetted Hydrogen	1·60	"

When water has been saturated with one gas and is exposed to the influence of a second, it usually allows a portion of the first to escape whilst it absorbs an equivalent quantity of the second. In this way, a small portion of a difficultly soluble gas can expel a large volume of an easily soluble one. The amount of aqueous vapor in coal-gas varies with the temperature.

Nitrogen.—This is another of the gaseous elements. It exists in a free state in the atmosphere, and enters into the composition of a large number of animal and vegetable substances. All descriptions of coal contain small quantities of this element. When nitrogen is eliminated from combination in contact with an excess of hydrogen it generates ammonia. It is in this latter form that it is eliminated from coal in the process of gas-generation.

Nitrogen is a colorless, inodorous and tasteless gas of specific gravity 0·976. It is incombustible under ordinary circumstances, and extinguishes burning bodies. Under certain conditions, however, nitrogen does undergo combustion, as when it is exposed to a very intense heat in the presence of oxygen. This occurs, for instance, when a small quantity of nitrogen is added to a mixture of hydrogen, with a somewhat larger proportion of oxygen than is requisite to form water, and the mixture is then ignited; a loud explosion takes place, and a considerable quantity of nitric acid is formed, owing to combustion of the nitrogen, or, in other words, its union with oxygen gas. This formation of nitric acid no doubt occurs also to a limited extent during the burning of coal gas; and as the temperature required to form nitric acid is very high, the greater the volume of gas consumed from one burner in a given time, the greater will be the relative quantity of nitric acid produced. The formation of such a corrosive material as nitric acid under these circumstances shows the importance of preventing the admixture of the products of the combustion of coal gas with the atmosphere of the apartments in which it is consumed.

The presence of free nitrogen in coal gas is probably due directly to the admission of atmospheric air, and not to the elimination of the nitrogen contained in the coal; for this latter nitrogen appears to be evolved only in combustion with hydrogen as ammonia. As nitrogen is incombustible, it is not only a useless ingredient in coal gas, but owing to its abstracting heat from the flame of such gas it causes a diminution of light, and is thus decidedly injurious. The admixture of this element therefore is to be avoided as much as possible.

Ammonia.—Ammonia is formed during the distillation of coal, and of all organic substances containing nitrogen; the latter uniting with the hydrogen present in the proportion of fourteen to three ($N H_2$). It is a colorless gas, specific gravity ·5898, very pungent, acting strongly on the nose and eyes when respired. It dissolves in a very small portion of water, one volume of this liquid taking up about 780 volumes of the gas, forming a liquid possessed of similar properties, and sold in the shops under the name of *spirits of hartshorn*. Ammonia is strongly alkaline, uniting readily with all the acids, and forming salts which sublime at a comparatively low temperature. It also unites with sulphuretted hydrogen, producing a highly offensive volatile substance. Gaseous ammonia unmixed with other gases is incombustible, but when present in coal gas it burns with the latter, and is converted principally into nitric acid.

The greater part of the ammonia produced in the manufacture of gas is found in the liquor which floats on the surface of the bituminous substances in the tar-well. It is collected and sold to the manufacturers of ammoniacal salts, and is also now largely used as a purifier of coal gas as described under the paragraph relating to bisulphide of carbon and organic sulphur compounds. In the account of the secondary products will be found a description of the best methods of separating and using it.

Carbon.—This element is well known under the form of diamond, charcoal, lamp-black and coke, all of which substances are carbon mixed with small and variable foreign matters. A knowledge of the chemical properties of carbon is of great importance to the gas manufacturer, as this element is the basis of the illuminating gases.

Carbon, as we have already mentioned, does not combine with oxygen at ordinary temperatures, but does so with great energy on the application of a strong heat, emitting at the same time intense light, which increases in brilliancy as the temperature rises. It is not however the particles of carbon which are actually undergoing combustion that emit this light, but those which are heated to incandescence, or are suspended for an instant within the flame before they come in contact with the atmospheric oxygen. This important fact will be again referred to.

Carbon only exhibits an affinity for hydrogen at the temperature of the electric arc, unless these elements are under the influence of the vital force, as in the bodies of animals and the tissues of plants. Under that influence they unite in almost innumerable proportions, forming a most extensive and highly important series of bodies, known under the name of hydrocarbons.

Carbon unites with oxygen in two proportions, forming carbonic oxide and carbonic acid gases.

Carbonic Oxide.—This is the lowest state of oxidation of carbon; it contains one equivalent or twelve parts by weight of carbon, and one equivalent or sixteen parts by weight of oxygen. This gas is formed when carbon is consumed in a limited quantity of air or oxygen, and is also generated, as previously stated, when steam ispassed over ignited coke or charcoal, or when coal-tar and steam meet in a red-hot vessel. It is always a constituent of coal gas in the proportion of five to fifteen per cent.

Carbonic oxide is a colorless and inodorous gas, rather lighter than atmospheric air, and having exactly the specific gravity of olefiant gas, ·9727; it is very sparingly soluble in water, but is very soluble in an ammoniacal solution of subchloride of copper. Carbonic oxide is inflammable, burning with a beautiful blue flame, almost devoid of illuminating power. The product of its combustion is carbonic acid. One cubic foot at 60° Fah. and 30 inches barometric pressure, consumes during combustion half a cubic foot of oxygen, generates one cubic foot of carbonic acid, and yields heat capable of raising 1 lb. 14 oz. of water from 32° to 212° Fahr., or causing a rise of temperature from 60° to 66.6° Fahr. in a room containing 2,500 cubic feet of air. Carbonic oxide is very poisonous, two per cent. of it in air being fatal to small animals.

(To be continued.)

Study on Coal Tars and their Products.

EXHIBITED IN 1867.

By Professor H. Dussauce, Chemist.

[Translated for the American Gas-Light Journal from "Studies on the Exposition of 1867," published by Eug. Lacroix, 15 Quaie Malaquais, Paris.]

II. Coal Tar—Treatment.

As we have said before, coal tar is produced by two industries, viz.:

1. By gas works.
2. By the fabrication of metallurgic coke.

These two sources of the crude material, while giving a tar containing about the same products, present, however, particularities special to each, which will oblige us to speak separately of them, inasmuch as the industry of metallurgic coke with the collection of the tarry products is entirely new.

We shall not speak here of the industry of gas, we shall recall only that the tar separates from the gas by cooling, at first in the receptacle, immediately after its exit from the retort; then its condensation is achieved in a complete system of pipes cooled at first by the surrounding air, then by cold water. At the same time the tar, and ammoniacal waters, are condensed, and the whole passes into cisterns in which the tar, being heavier, is easily separated from the waters.

This tar is at first distilled, near the gas works, in large sheet iron retorts, of a capacity of about 5000 gallons. The larger the apparatus, the better is effected the separation of the most volatile from the heavy and less volatile oils.

These retorts having no pressure to stand any shape can be given to them. By experience we recommend as the most simple and the most convenient the cylindrical form, in a horizontal position, and the reason is this, the distillation of tar leaves a residuum of pitch, which, if too much heated, leaves a residuum of coal; the retorts cannot be heated with naked fire; the hearth is covered with a vault, and the hot air alone circulating in the openings, touch the sides of the retort. These flues, for the utilization of the heat, ought to give the largest surface of heat, but on the other side the residuum product diminishing to thirty and even fifty per cent. of its volume by distillation, the level of the liquid in the kettle ought to be always above the heated area; consequently the horizontal cylindrical form is the best to fulfill these conditions, for as the kettle is filled a little above the axis, all the dimunition of volume of the tar is made in the part of the cylinder having the largest capacity, even for fifty per cent. of diminution the level is very little lowered, and the flues can, consequently, be raised much higher than in a retort with rectangular section, and embraces a much larger part of the surface.

The retort, or great horizontal boiler, is provided at the part opposite to the hearth, with a very large cast iron cock, used to draw the pitch, which is always liquid while warm; the emptying must be complete, and for that purpose the cock is fixed at the bottom, and the retort is slightly inclined to that side. To empty the cylindrical form is the best, for if the bottom was flat the pitch will spread on a very large surface.

The retort is, besides, provided with a man hole for cleaning, and is used at the same time for filling; also with a large tube surmounted with a head, for the evacuation of the distilled products; a little tube in the head ought even to permit the introduction of a thermometer, the bulb of which dips in the vapors. The temperature of ebullition raising from 95 deg. Fah. for the products the most volatile, until a little above 572 deg. at the end of the distillation, we must heat with a hearth, as steam cannot be used, nor even an oil bath, which can be employed for lower temperature.

It has been tried to have the distillation continue as that of alcohol, by introducing continually fresh tar and evacuating the pitch, but on account of the considerable proportion of the latter, and the small proportion (three to six per cent.) of the volatile oils; these processes have no great importance.

The most original process is that of M. Mallet, who has had the idea to make the tar circulate on a lead hearth, long enough for that purpose; during its course it was deprived at first of all its volatile oils, then of the other oils boiling at a higher temperature. The tar enters at one end of the apparatus and goes out at the other end in the state of pitch. The division of the volatile products is made by means of partitions dipping in the tar, and which, without preventing its circulation, separate the vapors into three or four classes. Even supposing that in this apparatus the pitch was always produced in the required state of dessication and the oils fractioned, its use does not offer many economical advantages. In our opinion, the most simple way is to operate the distillation as first described and by giving the kettles the best form and the largest possible dimensions necessary for a good division of the oils.

Whatever process is employed, the operation ought to be continued, according to the nature of the tar and the residuum to be obtained, until the tar has lost from twenty-five to forty-five per cent. of its weight. The distiller is guided by the quality of the pitch he wishes to obtain, and experience alone gives the necessary indications. Three kinds of pitch are produced: 1. The pitch, liquid when cold or at least pasty, which is the residuum of the tar from which the operator extracts only the oils lighter than water, that is the most valuable and containing the benzine. This pitch is used to manufacture agglomerated charcoal.

2. The fat pitch, solid at the ordinary temperature, but softening by heat and spreading easily. This pitch is used to manufacture artificial asphaltum, and is put into barrels for exportation.

3. The dry pitch, very hard and brittle, not changing by the greatest summer heat, which permits it to be shipped as coal. It is used to manufacture agglomerated coals. Several establishments use more than five millions of pounds, which represent at least a production of 100,000 tons of agglomerated coal.

When the pitch is too dry, the consumer, to use it, is obliged to melt it with some heavy oil, which increases the expense, and as the dry pitch is produced so to not to be obliged to put it into barrels, and as in cold weather the fat pitch becomes brittle, we recommend manufacturers to extract less heavy oils in winter than in summer; it has two advantages, less wearing of the kettles and no collection of the last oils which have less value.

When the distillation of the tar is to the required point, to obtain as a residuum the first described product, stop the heat and let the retort become cool so that the pitch will not take fire and produce vapors which would incommodate the workmen.

This pitch is extracted by the cock placed, as we have said before, at the bottom of the retort, on the opposite side to the hearth. To avoid fire this cock passes through the wall of the room, and the running of the pitch is done in the open air.

The *liquid pitch* can be immediately received in iron barrels, which are used to carry it to the shop in which it is used.

The *fat pitch* is received in sheet iron receivers, closed at the upper part, in which it is left to cool until, it being yet liquid, it can be drawn off into old wooden casks.

The *dry pitch* on the contrary is immediately directed into large ditches, in which they are left to cool completely. To facilitate this cooling, the ditch is only three feet deep. As soon as a full ditch is completely cooled, the pitch is shipped in blocks.

As to the volatile products of that distillation they are condensed by the ordinary means, that is, the neck of the large retort conducts them into a room made cool by running water. However, for the tars containing much napthaline, and when the operation is done to obtain dry pitch, the room must not be kept cool until the end of the operation; the oils ought to come out condensed but warm, which is no trouble, for they are very little volatile. Without that precaution the naphthaline, which crystalizes easily, will obstruct the warm oils and occasion accidents.

During this operation the products at first are very volatile, then less easily disengaged, the temperature of ebulition increasing until the end.

Indeed, the essences most volatile, amylene, benzine, toluene, evaporate at 102°2, 176° and 230°, while the last, hydrocarbons and naphthaline as an example, disengages only at 413°6. Other substances pass that point—the quinoleine boils at 446°; there are some the boiling point of which is above 572°.

The separation of those products is done in the following manner; they fraction in three parts, all the volatile products, each being condensed in a special receiver.

The first fractiou comprises—

1st. The water always contained in tars—water saturated with ammoniacal salts.

2nd. The whole of the most volatile oils, the principal of wbich are

Aniline	boiling at.....	102°2 Fahr.
Benzine	"	176° to 177°8.
Cumen	"	217°4 to 219°2.
Xylen	"	278°6.
Cumen	"	303°8.
Picolin	"	271°4.

This fractioning is stopped at the moment when the thermometer, dipped in the vapors of the retort marks about 300°. These products are always accompanied with phenic acid and other hydrocarbons, notwithstanding their more elevated boiling point.

Without the water the whole of the first fractioning represents a very variable proportion of tar, according to the quality and production of the latter. From three to four per cent. of the weight of the tar; we have seen that proportion increase to six and seven, and even eight per cent.

The whole marks at Baume's areometer is 25 deg. to 26 deg.

The *second fractioning* comprises, besides a little quantity of the above products, a large proportion of phenic acid, the boiling point of which is 370°4; a few other products, also acids, and naphthaline, which, notwithstanding its elevated boiling point 413°6 to 428°, is found in all the products. This fractioning is stopped at 392° and marks 15° Baume.

The *third fractioning* which contains yet more phenic acid and oils capable of being saponified, quinoleine, sometimes some aniline, a large proportion of naphthaline. All the oils having a high boiling point, constituto what is called the heavy oils. They mark 5° on Baume's areometer, water marking 10°.

(To be continued.)

A Manganese Mine.—There is a manganese mine at Red Rock, in San Francisco bay, twelve miles from the city, in which, it would appear, the oxide occurs in sufficient purity to warrant its working. Generally, in the United States the ore is too much associated with oxide of iron to be of commercial value. The mine is owned by the California Manganese Mining Company. The main tunnel is situated near high-water mark, from 250 feet to 300 feet below the summit of the rock. This tunnel has been extended forty feet southwards, cutting two lodes of manganese, denominated as the "front ledge" and the "back ledge." In the front ledge operations have been carried on for the past two months. The fullness of the ledge is demonstrated by the fact that in three weeks five miners extracted upwards of sixty tons of first-class ore, the market price of which is $30 per ton. Three thousand two hundred tons of manganese will not exhaust what is known to exist in this mine. The ore is extracted by contract at $10 per ton, the contractor agreeing to pay all expenses, from the raising of the ore to its delivery at San Francisco.—*Am. Exchange and Review.*

Gas in Japan.—A company is being organized in San Francisco for the purpose of introducing gas into Japan. The company will embrace some of the most solid men of that city, who feel assured that they will realize a handsome thing. Japan promises to be a good field for American enterprise, and capitalists with that shrewd foresight which is so eminent a characteristic of them, are beginning to take advantage of the opening in Japan.

Effect of the Atmosphere on Coal.

[From the American Exchange and Review.]

It is well known that coal is greatly affected by exposure to the atmosphere, especially the bituminous coals. The effect of exposure on this last class of coals has recently been most carefully investigated by Herr Grundmann at Tarnowitz, in Germany. Three years or more ago he had made a series of experiments of a similar character, and found that the coal exposed to the weather in heaps lost, during a period of nine months, 50 per cent. of its value as fuel. This result raised doubts of the accuracy of his observations. He accordingly now instituted a new set of experiments to correct or verify his former ones.

Meanwhile, Herr Varrentrapp, of Brunswick, experimented in his laboratory to the same end. He caused a current of air free from carbonic acid, to pass through a vessel containing small coal, and thence through a solution of baryta. Carbonate of baryta was precipitated. The fact was thus established that at ordinary temperature oxidation of the coal and the formation of carbonic acid took place, and that the quantity of the latter was much increased by raising the temperature.

He found also that in three months, with the heat kept uniformly at 284°F. (140°C.), all the carbon in the coal had passed off as carbonic acid. And yet this degree of heat is far less than is sometimes evolved in great heaps of freshly mined coal. These experiments went to confirm the results first obtained by Herr Grundmann.

The latter, in his new experiments, takes small coal, with no pieces more than two inches in diameter, of three different kinds and got from three different mines. Of them he makes in the open air three separate heaps, from four to five feet high, and twenty to thirty feet diameter at their base. The coal was the best coking and gas coal in Upper Silesia. From time to time during the year of exposure, average samples, selected with the greatest care, were taken for rigid and accurate analysis.

Large coal, in pieces of three or four pounds weight, was also included in the investigation, but it was kept under cover and not exposed as were the heaps of small coal.

During the period of exposure the coal underwent a process of slow combustion, taking up oxygen and giving off the volatile products of oxidation. In this decomposition air and moisture play the principal part, and warmth is the condition promoting it. The degree of heat determines the rapidity of the process. The heat developed may be sufficient to ignite the inflammable gases. The decomposition was the same in the interior of the heap as on the surface. The action was most rapid during the first few weeks of exposure, the heat generated by decomposition reaching its maximum about the third or fourth week. One-half the oxygen absorbed was taken up during the first fourteen days. The result shows that a coal oirginally poor in oxygen decomposes more rapidly than one rich in it; that coal dried at a temperature of 212°F. till its weight remains constant, can be heated up to 395°F. (200°C.) without further loss of weight. Hence moisture is an active element in the decomposition. Further, that large coal, exposing less surface to the action of air and moisture than small coal, is much less rapidly decomposed. The tendency, however, of large lumps having joints to fall to pieces on exposure is well known.

The analysis of the freshly mined coal of the several heaps gave the following composition:

	I.	II.	III.
Carbon,	76.51 per ct.	78.32 per ct.	81.21 per ct.
Hydrogen,	5.32 "	5.04 "	5.38 "
Nitrogen,	0.92 "	0.88 "	0.89 "
Oxygen,	5.83 "	8.08 "	5.72 "
Sulphur,	1.08 "	0.66 "	0.77 "
Ash,	10.34 "	7.02 "	6.03 "
	100.00	100.00	100.00

The results of the experiments are as follows:

SMALL COAL IN HEAPS.

	I	II.	III.
Absolute loss of weight,	33.08 p. c.	44.61 p. c.	42.19 p. c.
Loss of value as fuel,	47.69 "	56.81 "	55.38 "
" for gas,	45.51 "	47.95 "	50.29 "

LARGE COAL KEPT UNDER COVER.

	I.	II.	III.
Absolute loss of weight,	10.69 p. c.	6.36 p. c.	3.19 p. c.
Loss of value as fuel,	12.59 "	9.04 "	4.66 "
" for gas,	23.93 "	16.22 "	14.24 "

The great deterioration in quatity of the coal from exposure to the weather is thus most conclusively shown. It consists in the loss of the valuable combustible ingredients, and a relative increase of the injurious ones, sulphur, oxygen and ash.

The coking quality of this weathered coal was also correctly determined. The three coals yielded, when freshly mined, a firm, coherent coke, of very good quality. After exposure their character was quite changed. One of the coals at the end of eleven days yielded no coherent coke at all, while from the two others a coke was got, but of quite inferior quality, and the longer the coal was exposed the poorer was the coke.

For gas purpose also, the weathered coal had seriously deteriorated, as the above figures show.

Dangers of the Gas Made from the Volatile Constituents of Petroleum.

The volatile elements of petroleum called naphtha, gasoline, benzine, etc., offer such ready means for the manufacture of illuminating gas that attention has been naturally drawn to them as a cheaper materal, involving less labor for manufacture than the production of gas from coal or other substances. The extreme inflammability and readiness to explode at not excessive temperatures makes naphtha, benzine, or gasoline exceedingly dangerous. The lighter portions of petroleum are now largely employed for the generation of illuminating gas in isolated situations, where the ordinary gas works are not convenient, and the ease with which the gas can be produced from the liquid serves to recommend its use.

That this substance is dangerous and cannot be made safe by the means usually employed and the care usually exercised is proved by repeated catastrophes. The latest is an explosion near Gloucester, Mass., July 29th, by which several persons were dreadfully and one at least fatally injured. The facts are, that on the date mentioned a fire was discovered in a house belonging to a gentleman whose residence was about two miles from the town, the fire being in the basement where was located an apparatus for generating gas from naphtha. An explosion occurred by which a number of firemen were dreadfully injured, one dying the next day, some so burned that recovery is impossible and others dreadfully disfigured.

It would seem that no better direction can be given to the scientific and inventive talent of the country than attention to the properties and treatment of petroleum and its constituents, and devices for their safe manipulation and use.

Petroleum as Fuel at the Brooklyn Navy Yard.

An interesting experiment was made at the Brooklyn Navy Yard recently, involving the feasibility of substituting petroleum for coal for steam boilers. The apparatus used to test the experiment has been for some time preparing, and is the design of Lieutenant Clark Fisher, First Assistant Engineer in the navy, on "experimental duty" at the yard. The apparatus used for the purpose consisted of a pipe half an inch diameter, rising from the floor, and bent towards the mouth of the furnace somewhat like an elbow, and projecting two and a half inches beyond the grate. The opening in the end of the tube to let in the oil, regulated by a cock, is one-eighth of an inch in diameter around the end of the tube; and extending back four inches there was a larger pipe connected with the boiler. Now the tip of both these pipes, one within the other, and both not more than three-quarters of an inch in diameter, projected into a copper tube six inches long, one end within the furnace, one end without. This was the entire apparatus. The way it worked was this: The cock was opened in the oil-pipe; at the same time the steam was admitted to the other pipe surrounding the end of the oil-pipe. This steam passing out of the tube around the oil-pipe produced a suction, in obedience to which the oil began to flow. The stream in passing through the copper tube which conducts it to the boilers created a strong current of air within it, and the oil in passing out of it, goes into the furnace in the form of vapor; and when in this state it takes fire from wood previously placed there and ignited for the purpose. Last week only five pounds of steam were required in the boilers to work the apparatus. So soon as the oil is in its vapory state, once lighted, it is self-sustaining, and so complete is the combustion that no smoke at all is produced.

The boiler used was an ordinary 200-horse power gunboat boiler, with two furnaces. To each furnace there were five of the pipes admitting the oil, as already described. A barrel of petroleum was consumed in an hour, and seventeen minutes was the time required to get up a full head of steam. It is claimed for this application of petroleum to steam boilers, that it dispenses with a great part of the complex machinery usually necessary to raise steam, and by so much is a gain of power added to the propulsive force, that it obviates the friction, the loss of power, and the liability to explosion as well as the wear to material which the retort system of applying petroleum is likely to produce; that the fire can be extinguished at a moment's notice, and produces no smoke by which an enemy can tell the course and the approach of a vessel; finally that it requires for an engine of 200-horse power only the labor and presence of one man.

THE COST OF ARTIFICIAL LIGHT.—Professor Edward Frankland has recently delivered a course of lectures before the Royal Institution of Great Britain, and from his sixth lecture we extract the following table. The prices in the original are given in shillings and pence, and these are reduced to dollars and cents, by assuming one penny as equal to three cents.

COMPARATIVE COST *of the Light of* 20 *Sperm Candles, each burning for* 10 *hours, at the rate of* 120 *grains per hour.*

Wax	$2 59	Cannel Gas	$0 09
Spermaceti	2 40	Paraffin	1 38
Tallow	96	Paraffin Oil	18
Sperm Oil	66	Petroleum	23
Coal Gas	12½		

Brevities.

—Yokahama, in Japan, is to be lighted with gas.

—Glycerin affords an excellent coating for the interior of plaster molds.

—California produced $200,000 worth of strawberries last year.

—A paper mill has been erected at Golden City, Colorado, and is now turning out paper.

—Every thirty-five cubic feet of salt water displaced by a floating vessel are equal to one ton burthen.

—Silver is stated to have been reached in West Virginia by several mining companies.

—Milwaukie, like Chicago, proposes to have a lake tunnel to supply the city with pure water.

—An unsuccessful oil well in Indiana spouts sulphur water of a quality surpasssing the Virginia Springs.

—A western paper says, in reply to a question whether the Nicholson pavement is healthy, that all the contractors have got fat on it.

—The divisibility of copper is so great that a grain of it dissolved in an alkali will give a sensible color to 500,000 times its weight in water.

—Philadelphia claims to be the greatest manufacturing city in the Union. Her operatives number 96,983, and their gross earnings amount to $135,969,767 annually.

—The Rock Island Arsenal is to have a clock with illuminated dials twelve feet in diameter, and a bell weighing 3,500 pounds. The clock will furnish time for both the cities of Rock Island and Davenport.

—A lode of tin, between 500 and 600 feet wide, has been discovered in Madison county, Missouri, in the vicinity of Pilot Knob and Iron Mountain. This is said to be the largest single deposit known in the world.

—The Utica and Black River Railroad is to be extended. The contract for building the road from Lyon's Falls to Lowville has been let, and the work is to be completed by the 1st of August, 1868.

On the Absorption and Dialytic Separation of Gases by Colloid Septa.

BY THOMAS GRAHAM, F.R.S.

[From the London Chemical News, No. 351.]

It appears that a thin film of caoutchouc, such as is furnished by varnished silk or the transparent little balloons of india-rubber, has no porosity, and is really impervious to air as gas. But the same film is capable of liquefying the individual gases of which air is composed, while oxygen and nitrogen in the liquid form are capable of penetrating the substance of the membrane, (as ether or naphtha does,) and may again evaporate into a vacuum and appear as gases. This penetrating power of air becomes more interesting from the fact that the gases are unequally absorbed and condensed by rubber, oxygen 2½ times more abundantly than nitrogen, and that they penetrate the rubber in the same proportion. Hence the rubber film may be used as a dialytic sieve for atmospheric air, and allows very constantly 41·6 per cent. of oxygen to pass through, instead of the 21 per cent. usually present in air. The septum keeps back, in fact, one-half of the nitrogen, and allows the other half to pass through with all the oxygen. This dialysed air rekindles wood burning without flame, and is, in fact, exactly intermediate between air and pure oxygen gas in relation to combustion.

One side of the rubber film must be freely exposed to the atmosphere, and the other side be under the influence of a vacuum at the same time. The vacuum may be established within a bag of varnished silk or in a little balloon, the sides being prevented from collapsing by interposing a thickness of felted carpeting between the sides of the varnished cloth, and by filling the balloon with sifted sawdust. For commanding a vacuum in such experiments, the air-exhauster of Dr. Sprengel is admirably adapted. It possesses the advantage that the gas drawn from the vacuum can also be delivered by the instrument into a gas receiver placed over water or mercury. The "fall tube" has merely to be bent at the lower end.

The surprising penetration of platinum and iron tubes by hydrogen gas, discovered by MM. H. Sainte Claire Deville and Troost, appears to be connected with a power resident in the same and certain other metals to liquefy and absorb by hydrogen, possibly in its character as a metallic vapor. Platinum in the form of wire or plate at a low red heat may take up and hold 3·8 volumes of hydrogen, measured cold; but it is by palladium that the property in question appears to be possessed in the highest degree. Palladium foil from the hammered metal, condensed so much as 643 times its volume of hydrogen, at a temperature under 100 °C. The same metal had not the slightest absorbent power for either oxygen or nitrogen. The capacity of fused palladium (as also fused platinum) is considerably reduced; but foil of fused palladium, for which I am indebted to Mr. G Matthey, still absorbed 68 volumes of gas. A certain degree of porosity may be admitted to exist in these metals, and to the greatest extent in their hammered condition. It is believed that such metallic pores, and indeed all fine pores, are more accessible to liquids than to gases, and in particular to liquid hydrogen. Hence a peculiar dialytic action may reside in certain metallic septa, like a plate of platinum, enabling them to separate hydrogen from other gases.

In the form of sponge, platinum absorbed 1·49 times its volume of hydrogen, and palladium 90 volumes. The former of these metals, in the peculiar condition of platinum black, is already known to take up several hundred volumes of the same gas. The assumed liquefaction of hydrogen in such circumstances appears to be the primary condition of its oxidation at a low temperature. A repellant property possessed by gaseous molecules appears to resist chemical combination as well as to establish a limit to their power to enter the minuter pores of solid bodies.

Carbonic oxide is taken up more largely than hydrogen by soft iron. Such an occlusion of carbonic oxide by iron at a low red heat appears to be the first and necessary step in the process of acieration. The gas appears to abandon half its carbon to the iron, when the temperature is afterwards raised to a considerably higher degree.

Silver has a similar relation to oxygen, of which metal the sponge, fritted but not fused, was found to hold in one case so much as 7·49 volumes of oxygen. A plate of wire of the fused metal retains the same property, but much reduced in intensity, as with plates of fused platinum and palladium in their relation to hydrogen.—*Proceedings of the Royal Society.*

The London Gas Question.

A scheme which has been proposed by Mr. R. H. Patterson is apparently attracting some attention. Mr. Patterson believes that any attempt to fix the price which the companies should charge for gas would be a mistake. He thinks that ordinary trade principles are sufficient to decide this point, and that it is beyond the power or province of Parliament to touch it. He proposes that, in order to secure gas of the best quality, we should adopt a system akin to that of the Excise. He would have certain officers empowered to apply appropriate tests for illuminating power at the mains near the manufactory, and for purity near the extremities of the supply pipes, whenever and wherever they please. In short, that the gas companies should be treated as the distillers are. He recommends a system of heavy fines for the supply of gas of inferior quality, and these he would enforce, giving the inspectors a large share in the fines, in addition to a fair salary. With this check Mr. Patterson would abolish the Act of 1860, which limits the dividend to 10 per cent. He would fix 8 per cent. as a starting-point, and above this permit the companies to gain what profit they pleased, provided only that for every one per cent. so gained, *one-half per cent. should be appropriated to a deduction in the price charged for gas.* The half per cent. dividend would thus induce the companies to earn 1 per cent. by improvements in their process of manufacture, and the consumers of gas would profit equally with the companies by the lessened price consequent upon these improvements.

But Mr. Patterson's scheme comprises a still greater change. He thinks it desirable that the municipality should buy up the companies, and take the business into their own hands. The question arises, is the scheme practicable? To this Mr. Patterson replies as follows:

"The transfer of the property of the gas companies to the municipality (so to call it, or the aggregate municipal bodies) can be effected without any *direct purchase*, and *without any loan or other financial process* on the part of the municipality. All that is required is to convert the shares of these companies into city bonds of equal amount, bearing 10 per cent. of yearly interest. The funds necessary for the payment of interest on these bonds are already in existence; they are supplied by the proceeds of the rate at present levied upon the community by the companies. The only change which would be made would be that the present amount of the gas-rate would be collected by the municipality, and paid to the shareholders of the companies as interest on the bonds, instead of being collected by the companies themselves, and paid by them as dividend to their shareholders.

"This is all that is necessary in order, by one stroke, to transfer the property and interests of the gas companies to the municipality. *No loan or new rate would be needed at all.* And no loss could possibly happen to the municipality from the arrangement, seeing that the funds required for the annual payment on these new city bonds are already in existence."—*Builder.*

Death of Professor Faraday.

The renowned Professor Faraday died in London on the 27th of August, 1867. Michael Faraday was born in London in 1794. The son of a smith, he received but little instruction in his youth, and was apprenticed to a book-binder. His tastes, however, soon led him to the almost exclusive study of books, the construction of machines and the performance of chemical experiments, and hearing a course of lectures by Sir Humphry Davy in 1812, he sent to the lecturer a copy of the notes he had taken and requested his assistance to enable him "to escape from trade and enter into the service of science." Davy received the application favorably, and in March, 1813, appointed Faraday chemical assistant in the laboratory of the Royal Institution. In the Autumn of the same year, Faraday, as Secretary and Scientific Assistant, accompanied Davy in traveling, their journeys continuing till April, 1815. He then returned to the Royal Institution, with which he remained connected to the last, becoming Professor of Chemistry in 1833. Prof. Faraday's scientific pursuits are of historical record. He was early interested in electrical researches, assisting Davy in 1820 in prosecuting those first entered upon by Oersted on the relations of electricity and magnetism. Among popular lecturers, as among original experimenters, the deceased *savant* held the highest rank. Few scientific men received so many distinctions from learned societies and institutions. The Queen of England allotted to him in 1858 a residence at Hampton Court, and since 1835 he has received a pension of £300. His age at the time of his death was 73 years.

Mining Share Market.

The San Francisco Weekly Stock Circular of July 20, gives the market rates of mining stock as follows:

During the period under review the mining stock market has undergone a very marked change, a panic having occurred which affected nearly every stock on the list and carried some of them down to more than half the price obtained within less than two weeks previously. The decline has been so unprecedented that a large number of speculators have been cornered and will doubtless, in many cases, meet with severe losses, while others are improving the opportunity to obtain stocks at a rate which it is positive will not prevail for any length of time. Even capitalists in the East have been availing themselves, to some extent, of this serious decline, and within the past few days a considerable amount of capital has been transferred by telegraph for investment in this class of securities. Some persist in holding to the opinion that the mines are giving out, that the exhaustive process has been carried to its utmost limit. We cannot coincide with those views, but, on the contrary, believe that the favorable developments heretofore reported will increase rather than fall off. The productive condition of the mines on the Comstock Lode was not disputed two weeks since, and we have no reason to think that they have shown any signs of "petering out" within that brief period. At the close a reaction had taken place in most shares and the future looked brighter.

SAVAGE—Declined from $4,500 to $4,000, rallied to £4,400, and at the close sold at $4,400. The ore extracted during the week ending July 13th amounted to 2,099 tons, showing an approximate value of $77,647, or an average of $36 98 per ton.

CROWN POINT—Rapidly receded from $1,430 to $890, rallied to $1,300 and closed yesterday at $1,210.

YELLOW JACKET—Shows a further decrease in price since our last reference, having declined from $940 to $700, recovered to $900 and closed at $875.

GOULD & CURRY—Has been quite active, opening at $700@740, receding to $630, improving to $775, and closing at $725.

KENTUCK—Opened at $400, fell to $300, advanced to $410, and closed at $410. The receipts of bullion for the current month to the 15th amounted to $32,632 83. In June, from 1st to 17th, the returns sum up $45,800. The receipts and expenses, it is thought, will not vary much from last month.

CHOLLAR POTOSI—Declined from $430, seller 30, to $320, gradually advanced to $425, and closed at $450.

OVERMAN—Since date of last review fell from $220 to $110, and at the close sold at $170. We learn of nothing discouraging from this claim.

IMPERIAL—Receded from $213 to $182 50, and sold on 17th at $200. This company has received about $19,000 in bullion from the 1st to the 16th inst.

OPHIR—Opened at $300, dropped to $200, improved to $267, and closed at $230. There is some talk of sinking a new shaft on G street.

BELCHER—Declined from $360 to $210, advanced to $350, then sold at $285@310, and closed yesterday at $315....EMPIRE ruled uniformly at $180.

The aggregate sales of stocks, legal tender notes, etc. since Saturday last, amounted to $1,431,913.

—The Pacific Asphaltum company have an apparently inexhaustible mine of this substance convenient to San Francisco. The asphaltum, which has the solidity of coal—powder being used to blast it—and differing entirely from that heretofore used, is found at a depth of six to ten feet from the surface, continuing in solid masses about 15 feet deep, when soft and liquid matter is met with, which the company do not yet know how to employ, or dispose of.

☞ See page 79 for more reading matter.

PATENT CLAIMS.

Pertaining to Gas, Mining, Petroleum, Water etc.

67,265.—DEFLECTOR FOR HOT-AIR REGISTERS.—S. Hamilton Caughey, Baltimore, Md.

I claim the box, A, with its perforated top doors, E, d and G, and water-tank, arranged substantially as described and represented.

67,277.—VAPOR-BURNER FOR HEATERS.—Charles W. Duncan, assignor to himself and H. S. Saroni, Baltimore, Md. Ante-dated July 26, 1867.

I claim, 1st, In an apparatus for generating heat in vapor stove, as above described, regulating the supply of fluid to the retort or heating chamber, in the manner and by the means herein-before specified, that is to say, by locating the valve which regulates the flow of the oil or other fluid at or near the point where the fluid enters the said retort, substantially as and for the purpose herein set forth.

2d, In combination with the retort or heating chamber of a vapor stove, and valve-seat, located at or near the point of junction of said retort with the pipe, which connects it with the fluid reservoir, as specified, I claim the valve, constructed and arranged so as to operate on the axis of the said pipe, substantially as and for the purposes herein shown and described.

67,840.—VALVE FOR GAS GENERATORS.—John H. Beacher, Philadelphia, Pa.

I claim, 1st, A valved regulator, constructed and operating substantially as set forth, in combination with and forming a part of a gas generating apparatus, as specified.

2d, The throttle valve composed of two disks, with intervening strips of leather, as set forth.

67,845.—PORTABLE FORGE.—John M. Cayce, Franklin, Tenn.

I claim the arrangement in a portable forge of the fire-pot, D, the side tubes, X, K, discharging currents of air that meet at the centre of the fire-pot with the fans, F, F, the treadle, H, and the ool-sheif, L, as and for the purposes specified.

67,858.—CLOTHES WASHER.—F. Ernst, San Francisco, Cal.

I claim placing the fabrics to be washed between perforated plates or sieves, C and D, in a closed vessel of any suitable construction, so that a vacuum, F, may be created beneath the lower plate, substantially as described.

67,867.—STEAM ENGINE OIL-CUP.—F. H. Furniss, Cleveland, Ohio.

I claim, 1st, In combination with an oil-cup a pawl and rachet, ro arranged as to operate the key or plug of said oil-cup, substantially as set forth.

2d, The pendulum, F, rachet-wheel, J, and pawl K, in combination with the plug, E, substan tially as and for the purpose set forth.

3d, The guage or regulating screw, F, and plug, D, in combination with the oil-cup, substantially as and for the purpose described.

67,877.—CAR VENTILATOR.—Robert Hitchcock, Springfield, Mass.

I claim the combination of the valve, F, having the cap, c, with the case, A, having the pieces, C and C', vent-hole, F, the whole being constructed and arranged substantially as described.

67,907.—APPARATUS FOR MAKING NITROUS OXYD, ETC.—M. B. Renslow, assiguor to himself and Flavius Searle, Springfield, Mass.

I claim, 1st, Controlling the amount of heat used in generating nitrous oxyd or other gases, by means of a regulating or changeable outlet, p', applied to a gas-receiver having a variable capacity when used in combination with a device for regiuating the flame, beneath the generating retort, substantially as described and herein set forth.

2d, The variable receiver, a, having a changeable outlet, p', in combination with the rod, e, and the lever, f ', all constructed and operating substantially as described and for the purpose specified.

3d, The variable receiver, a, having a changeable outlet, p', in combination with the rod, e, the bar, d, and lever, d', all constructed and operating substantially as described and for the purpose specified.

4th, In combination with the lever, f', I claim the spring, y, and piece, f', having the pin y', all constructed and operating in the manner and for the purpose herein specified.

Miscellaneous Items.

—Nicholson, the owner of the patent for the wooden block pavement, has obtained judgment against Chicago for $30,000, for the unauthorized use of his pavement.

—A quarry of stone suitable for mill-stones has just been opened in middle Georgia—said to be fully equal to the celebrated French Burr stones, which have heretofore been the only reliable mill-stone in America.

—The San Francisco Water Company have filed articles of incorporation, with a capital of six million of dollars, and propose to supply the city with water from the Santa Cruz mountains.

—A fine meteoric display was witnessed between 2 and 4 o'clock in the morning of the 13th ult., at Poughkeepsie, N. Y. Three very large and brilliant meteors passed from northeast to south, and hundreds of small ones were seen.

—Two tons of gunpowder was fired in a mine of the Salt Lime Works Company, Clitheroe England, and the explosion which followed the lighting of the train resulted in the displacement of about 20,000 tuns of stone.

—Ohio has just now two mining excitements; one is a gold mine discovered in Richland county, the other a silver discovery in Washington county. The former locality has been visited by a Cincinnatti scientist who reports extensive deposits of gold ore, the best specimens being found near Bellville on the borders of West Virginia.

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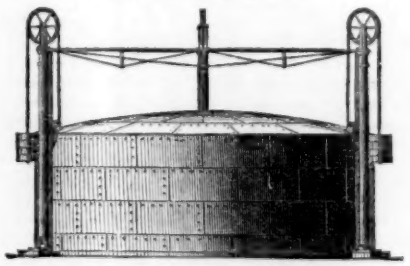

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At the opening of the Exposition an address will be delivered by the Hon. HORACE GREELEY, President of the Institute, and a poem by CHARLES G. HALPINE, Esq., (Miles O'Reilly).

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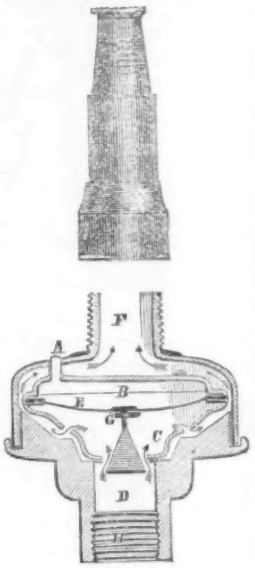

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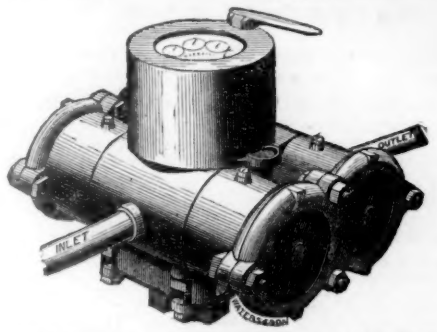

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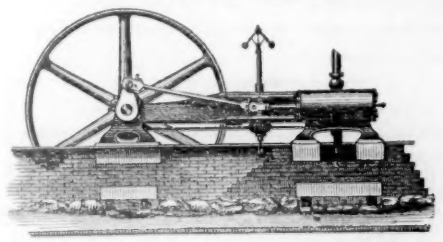

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EDITORS AND PROPRIETORS.

MONDAY, SEPTEMBER 2, 1867.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

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Answers To Correspondents.

J. A. B., of Mass.—A good dip for castings of brass is, one quart vitriol, one quart nitre, one quart water. The mixture must be stirred when used.

L. A., of Ky.—An excellent cement for marble or stone in exposed places is made as follows: Twenty parts clean white sand, two of litharge, one of quick lime mixed to a putty with linseed oil. Half the sand may be replaced with an equal amount of marble dust where the joining is for broken marble. It gets hard as stone.

E. N., of Mass.—Scythe rifles are made by fastening emery to wood of the required shape with glue. Pulverized slate is employed in the same way to make whet-stones and hones.

S. P., of N. Y.—*Vis viva* is the force of a moving body and is in proportion to the square of its velocity, and the power required to impart velocity is in the same ratio. It, therefore, requires an expenditure of four times the force to impart double velocity, either to a revolving wheel or projectile.

A MINIATURE VOLCANO.—Prof. Choutard, filling the chair of Natural Philosophy at Nancy, France, has devised the following experiment, showing the power of Ruhmkorff's induction coil: A quantity of the flowers of sulphur is mixed with a small proportion of iron filings, or, better still, with iron reduced by hydrogen, in which case it is in quite an impalpable state; zinc and copper filings may also be used in small quantities. The mixture, made as complete as possible, is placed on a pane of glass or a dry brick, so as to form a heap two or three centimeters high, and much longer than broad. The ends of the wires of a Ruhmkorff apparatus are inserted into the heap, so as to be two or three centimeters distant from each other. When ready, a current of electricity is sent through the coil, and instantly a violent explosion takes place. A sort of crater is formed, whence magnificent sheaves of fire are seen to issue, displaying colors like a bouquet of fireworks. It is in reality a volcano on a very small scale, having its subterranean noises, as it were, and ejecting boiling lava.

GAS IN NEW YORK AND VICINITY.

Of the half score of gas companies that supply the business of New York and the families dependent on it, four are located in the city proper. The original New York Gas-Light Company, chartered in 1822, the same year in which the first successful American gas works were started in Boston, supplied the bulk of the built city as it then existed, and for forty-two years has carried on the manufacture for a district mostly settled and constant in its demands, embracing that part of the city below Grand street. The Manhattan Company, now the largest concern in America, and among the best appointed and managed in the world, was started in 1830 to meet the demands of the growing city above Grand street. Its capital was $1,000,000, subsequently increased to $4,000,000, with a restriction upon the price of its gas, which was not to exceed $2.50 per thousand cubic feet, and at this moderate price the consumers of the Manhattan district still obtain it: a price which was profitable before the war, and which the company had even taken steps voluntarily to reduce, but which is now relatively to other prices and the cost of manufacture, lower by at least one dollar than at the time when it was fixed. The Manhattan gas district now extends from Grand to Thirty-fourth street, and embraces at present the bulk and the best of the dwellings and retail stores of the city, in which gas is principally consumed. Consequently, this company makes and sells more gas than all the other companies in New York and Brooklyn together, with the addition, probably, of the suburban companies on the New Jersey shore, etc. It has eighteen full-sized gas-holders and 1,900 retorts in operation, in two establishments, either of them larger than any other in America; one at the foot of West 18th street, on the North River, and the other at the foot of East 17th street, on the East River. The old New York Company has six receivers and 522 retorts at the foot of East 21st street. The Metropolitan Company, started about four years ago for the district between Thirty-fourth and Seventy-ninth streets, is probably destined to deserve, *par excellence*, its name, and eventually to overtake the first rank, but has now only four receivers and say 300 retorts, at the foot of West Forty-second street. The Harlem Company, taking the rest of the island, from Seventy-ninth street to the Harlem River, has two receivers and from 75 to 80 retorts at its works, foot of Two Hundred and Fourth street, on the Harlem River, and a third receiver near King's Bridge, at present superfluous as to capacity, but necessary to afford an even pressure between the general city level and Washington Heights. All together, including the three Brooklyn companies (the "Citizens" of South Brooklyn, the "Brooklyn" of the old city, and the "Williamsburgh," of the Eastern district), and at least three more in the minor suburbs; the gas companies of New York and its dependencies may be called ten in number, having an aggregate storage of over ten million cubic feet in forty gas-holders, working between three and four thousand retorts, turning out fifteen hundred million cubic feet of gas per annum, and collecting between four and five millions of dollars from the citizens.

The above "little bill" seems rather stunning, whether considered in the aggregate, or divided among a million or more of people, at say four dollars a year per head. But it would be a mistake to consider it as the index of a high-priced commodity: It illustrates rather the luxury to which city conveniences tend, the lavish expenses of metropolitan traffic and gaiety, and the expensiveness of protection for great, dense and mixed masses of people and property. Large amounts of gas, for instance, are burned through the night, in closed stores and offices, for the protection which a brilliant illumination affords against burglars; and the cost of the forty or fifty thousand street gas lights which are indispensable to personal safety and public morals, is a heavy tax inseparable from the nature of the case. Yet the chief cause of this great expense for light, is the fact that the light is so good and so cheap that it is not in human nature to stint itself here to the feeble twilight from lamps and candles which rural people are accustomed to be content with. A single ordinary gas burner in New York, emitting five cubic feet of gas per hour, at a cost of say three mills per foot, or a cent and a half per hour, gives a light equal to fifteen standard sperm candles—at least, such is the rate of illuminating power which our companies generally agree to maintain. To read or sew by the light of a single candle, as people do in the country, would cost here but *one mill* per hour; provided the illuminating power of a gas jet could be so minutely subdivided. In practice, however, it is found that the proportion of illuminating power to a given bulk of gas consumed, is greatest when the whole is burned in one flame, and is diminished with every subdivision: combustion being more effective in proportion as the body of burning fuel is greater and stronger, and less so as the fuel is enfeebled in volume, until it diminishes to a point where it cannot even sustain itself, and goes out. The intrusion of the atmospheric air, which tends to cool the flame, and also by admixture to destroy the illuminating power of gas, is also more effectual in proportion to the subdivision of the gas in the atmosphere, in numerous small flames. Dr. Frankland found the illuminating power of one cubic foot of a certain gas to be equal to that of one hour's light of six and a half candles, when the former was burned at the rate of only one foot per hour; but on burning it at the rate of five feet per hour, the twenty minutes gas-light was equal to an hour's light of ten and a half candles; an increase of over 60 per cent. in value. He asserts that one hundred feet of gas burned in a given time through a single burner, will give more light than if passed through twenty burners.

The above is one theory: another is, that combustion is perfected by exposing the subdivided flames to a thorough access or admixture of oxygen from the atmosphere; converting the fuel instantly into colorless and hence unluminous carbonic acid and steam, and producing more heat but less light in proportion to the gas consumed; as any one may see by spreading a gas flame over a large area, or turning it down to a blue flame, or throwing it into a score of little blue jets, with increased heat and no deposit of soot. A bulky jet, on the other hand, keeps up an excess of incandescent fuel at a white heat, not instantaneously oxidized (not all of it oxidized at all, as its soot shows), and hence lingering momentarily in a luminous condition. Dr. Frankland's suggestion, quoted in another article, is not out of harmony with this view; although, in discussing this point, he inclines to the former theory, attributing the greater proportional luminosity of a large flame to a higher temperature, consequent upon a smaller relative cooling surface.

Chemists and manufacturers know that the best gas, which of course costs most, is nevertheless the cheapest. It would be manifestly for the interest of all parties, if this information could be popularized. Probably, with the great cost of bringing cannel across the Atlantic, under the present conditions of commerce, our light would not be cheaper, while our gas would be higher priced, for the introduction of a large proportion of that valuable ingredient. The use of cannel among us is now mainly confined to cold weather, and then in the proportion of about one fourth, the rest being Pennsylvania and Nova Scotia coals. But we have it from the same eminent authority already quoted, that in England the common coal gas costs the consumer (at a lower price per foot) nearly fifty per cent more, light for light, than the best cannel gas. The latter, he shows, costs the Londoner in ten hours, for the light of twenty sperm candles, 3d., against 4¼d. for common coal gas, 6s. 8d. for sperm candles, 2s. 8d. for tallow, 1s. 10d. for sperm oil, and 7 2-3d. for petroleum. London, however, profits little by this kind of knowledge, for its gas is inferior to any other of which we have authoritative data before us, except that of Vienna, although it is little worse than that of Paris; the actual standards in the three cities named being, respectively, twelve and one-tenth candles, twelve, and twelve and three-tenths. On the other hand, the Scotch towns enjoy a splendid illuminating agent, of 35-candle power in Aberdeen, 30 in Paisley and Hawick, 28½ in Greenock, and 28 in Glasgow and Edinburgh. Manchester and Liverpool have 22; Birmingham and Berlin 15. Sugg's new burner, Dr Frankland states, from its improved construction, gives the London gas 1½ candles greater power than above quoted.

Dr. Frankland attributes the inferior quality of the London gas to the adoption of the cheap methods of purifying by means of iron ore instead of lime; a process which leaves untouched the carbonic acid in the gas, and thus impairs its power to the extent of 11 or 12 per cent. Compounds which generate in combustion noxious quantities of sulphurous acid are also left in the gas. It is a singular fact that our New York Board of Health have taken much pains to insist upon having the same substitution introduced here, under the impression that the unpleasant but innoxious odor of sulphuretted hydrogen would thus be diminished; but forgetting,

apparently, that besides a poorer and more expensive light, we should be afflicted with the serious sanitary evil of sulphurous acid, and of a redoubled evolution of carbonic acid from our lights: that produced by the necessity of burning more gas, in addition to the amount pre-existing in the gas as an impurity. The Manhattan Company, we are told, would save from $300 to $400 a week by the change, in the cost of lime alone; but the cost to the inhabitants of the city would be enormous in health and cash, if Dr. Frankland is any authority. At the same time, it is believed that the process adopted by that company, exhausting and repurifying the residue of foul gases in their pans, before emptying them, is more effectual than any other plan yet adopted for removing the nuisance of sulphuretted hydrogen.

Dr. Frankland gives us the tests of the new American cannel of remarkable quality, recently discovered in New Brunswick, which may prove of some importance to our gas manufacturers and consumers. Five feet of gas from this cannel equalled an hour of 52.6 sperm candles, and the cannelite accompanying it gave 37.8 against 40 from Lesmahago and Leeswood, and 34.4 from Newcastle cannel, 27.8 from Methill, 22.1 from Wigan, and 11.9 from Newcastle coal.

DR. FRANKLAND'S THEORY OF LUMINOSITY IN FLAME.

The idea that the luminous constituent of the gas flame consists of incandescent particles of carbon, is very forcibly impugned by Professor Frankland, in his recent popular lectures in London. The visible array of experiments in which the elements of coal gas other than carbon, and a number of distinct substances besides, were made to show every degree of illuminating power without the presence of a particle of carbon or of any other solid particles whatever, were highly satisfactory to the audience on this point. The ignition of mixtures of hydrogen and oxygen, carbonic oxide and oxygen, and hydrogen and chlorine, was exhibited with highly luminous effect, by simply confining them so that their expansion was prevented. Arsenic and oxygen, bisulphide of carbon and oxygen, and nitric oxide and bisulphide of carbon, were also burned together with dazzling effect, demonstrating that solid particles in the flame cannot be a necessary condition of luminosity. Temperature was also shown to be not the effectual factor in the luminous process, for the hottest of flames, that of hydrogen and oxygen, is almost without light. The production of the most brilliant light from otherwise lightless compounds by means of compression, compared with the general fact that the bodies which yield most light are those whose combustion yields the densest products, lead the learned professor to the conclusion that the relative luminosity of flames is roughly proportional to the relative density of their products. Thus, the density of water vapor, the product of the combustion of oxygen and hydrogen, is but 9, (hydrogen being 1): but the density of carbonic acid, the product of carbon and oxygen, is 22; while the density of sulphurous acid is 32, and that of arsenious acid, produced along with the intolerable light of burning arsenic and oxygen, is 198. This theory was further confirmed, by reducing the ordinary atmospheric pressure under which the above substances were burned, by means of exhaustion, without diminishing the supply of oxygen or the volume of the flame. The invariable result was a perceptible and proportional diminution of the light. Again, putting a lightless spirit flame under pressure, it was made very brilliant.

Finally, the transformation of the simpler hydrocarbons into those of greater complexity, and consequently of greater vapor density, by direct condensation through the agency of heat, is taken as the means of accounting for the luminosity of gas flame. In the unluminous marsh gas, or light carburetted hydrogen, under the influence of heat, the hydrogen gradually separates from the carbon, while the atoms of the latter element shrink more closely together, as it were, so that two volumes of marsh gas become condensed into one, forming acetylene. But not stopping here, the condensation proceeds to the formation of naphthalene, the vapor of which contains ten times as much carbon as marsh gas; having proceeded at the same time in density, from marsh gas, 8, to acetylene 13, and naphthalene, 64. Still further on are chrysene and pyrene, in which the carbon atoms are still more closely packed than in naphthalene, and the vapors of which being very dense, according to the law pointed out, are attended by exceedingly luminous flame. The lighter hydrocarbons, Dr. F. thinks, are transformed in the intense heat of the flame, into dense vapors which have the luminiferous character of arsenic vapor or phosphorus vapor. The sooty deposit from flame, erroneously supposed to be uncombined carbon, Dr. F. shows to be an agglomeration of condensed hydrocarbons.

THE GAS QUESTION IN CINCINNATI.

The City Council of Cincinnati, Ohio, met on the 16th inst., and passed the ordinance 20 to 8, regulating the price of gas to $2 per 1000 cubic feet. So, after all, this vexed question will, in all probability, be decided by a court of law. There was some discussion by the members upon the subject. Mr. Beckman said that he objected to the purchase upon the theory of Stuart Mill, that corporations should not be manufacturers, and secondly, that he did not wish to burthen an already overtaxed community. Mr. Edwards wished to know wherein was the necessity to expend $3,000,000 for the purchase of the gas works if the council had the power to fix the price of gas, and asserted that he was opposed to making the gas works a political vehicle.

We have no doubt the gas company will resist this arbitrary proceeding of the city council, and the city will be put to an expense in time and money to carry on the legal contest, which it will be difficult to estimate. In the mean time, the other legal obstructions to the transfer of the gas works to the city, will need to be cleared away, which is not likely to be soon. Probably the company will furnish gas to those consumers who are willing to pay their price, and those that do not will have the alternative of having their gas cut off. We see no way to arrange this matter except for the consumers to pay the company their price, (which is reasonable, since the l t reduction by the gas company to $2.75,) and wait for the decision of the courts. Perhaps, however, the sober, second thought may lead to a compromise, which would be just and fair to all parties, and this will be the better plan.

HYDROGEN GAS, ETC.

In our last number an item occurred wherein it speaks of the method employed to make hydrogen gas to inflate the balloon which makes hourly ascensions at the Paris Exposition. It says hydrogen gas is made by decomposing steam by means of red-hot charcoal, and that it can be furnished at $2.75 per 1000 cubic feet. They must certainly be behind the age of improvement there, or else the price of the gas "furnished" gave an enormous profit to the parties who furnished it. Hydrogen gas is made in this country by the decomposition of steam for less than 25 cents per 1000 feet. It is true they used charcoal there, which is more expensive than the material used here (coke or anthracite coal), and at a "*red heat*" they would make a large amount of *carbonic acid gas*, which would necessarily have to be removed at considerable expense, or it would detract very much from the buoyancy of the gas. Here coke or hard coal is heated to a white heat in clay retorts, because iron would be soon destroyed, and superheated steam is introduced, which is converted entirely into carbonic oxide and free hydrogen. This method of producing a cheap gas for heating and illuminating purposes is the basis of several patents obtained both here and in Europe, and the process is being introduced in a practical way with success, in several places. We shall soon have occasion to revert to this subject again more in detail.

WOOD AND COAL GAS COMBINED.

A letter from Augusta, Ga., informs us they are improving their works there materially, which is indicative that the city and its wants are increasing.

The works are under the superintendence of G. S. Hookey, Esq. A new retort house has been added, and five benches of the largest size D retorts, each bench containing three retorts, three benches of iron retorts and two of clay, and the largest size hydraulic main.

The brick walls of the old works have been pulled down and a new iron roof constructed, slated and well ventilated.

The gas is made from fat-pine and bituminous coal. The wood and coal are distilled in separate benches, but the gases from both pass through the same condenser and purifying apparatus, and into the same gas holder.

Our correspondent Wm. J. Conley, Esq., states that they formerly used wood; but the addition of coal increases the pressure in the same sized mains, and is otherwise advantageous.

We do not understand why the pressure is increased owing to the use of coal, unless the pipes ascend from the gasometer, then its gravity being less, probably, would have the effect described.

CLASSIFIED INDEX TO ADVERTISEMENTS.

Our readers will observe in the present number of this journal a valuable facility in looking for advertisements. At a glance they can see what advertisements of interest to them are contained in the paper, and where to find them. The index presents a striking summary exhibit of the variety of interests and subjects specially represented by a journal of this class—a class in which our paper stands alone in America. Advertisers will readily appreciate the benefit of this index—involving a double advertisement in fact for each of them—and will undoubtedly repay us by their increased appreciation, for the labor and expense thus bestowed.

A Good Business.—The Advertising Agency of George P. Rowell & Co, No 40 Park Row, N. Y., furnish regularly from one to three columns of advertising to nearly one half of all the newspapers in the Eastern, Middle and Western States.

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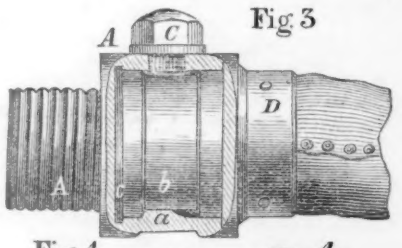
Fig 3



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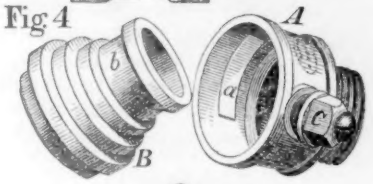

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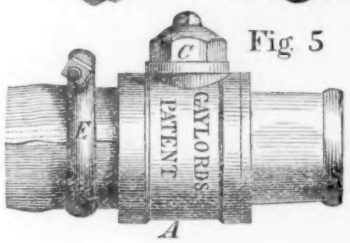

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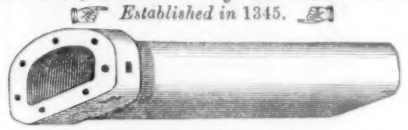

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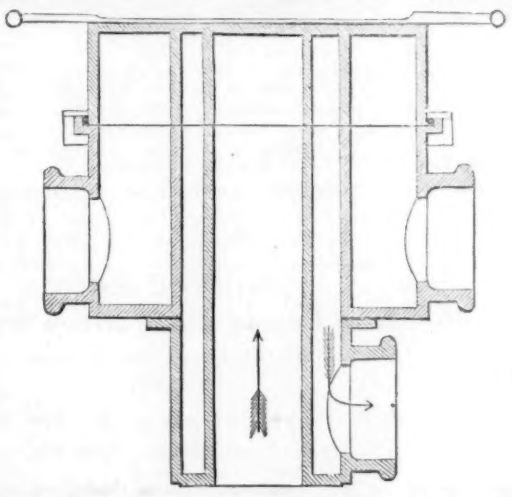

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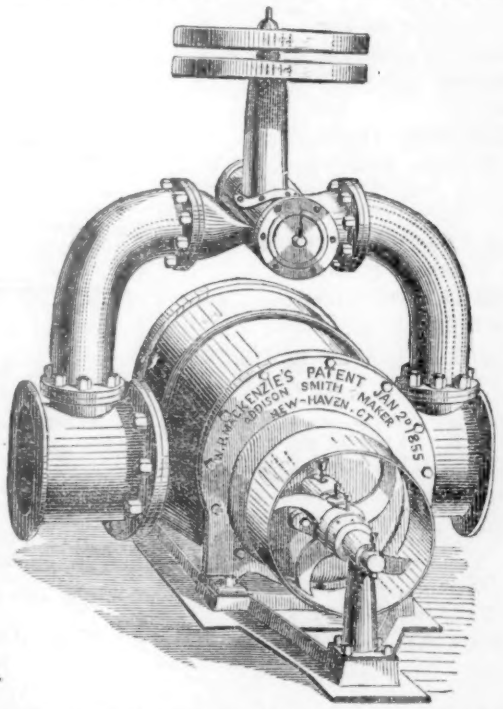

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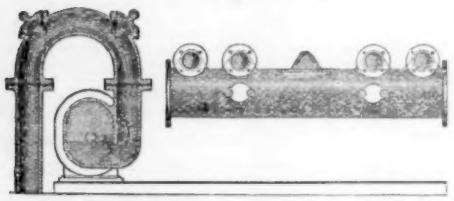

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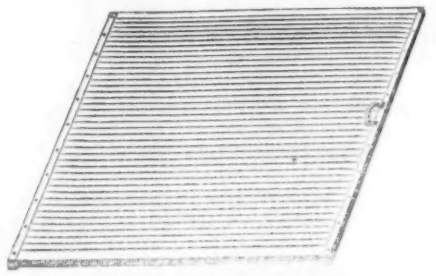

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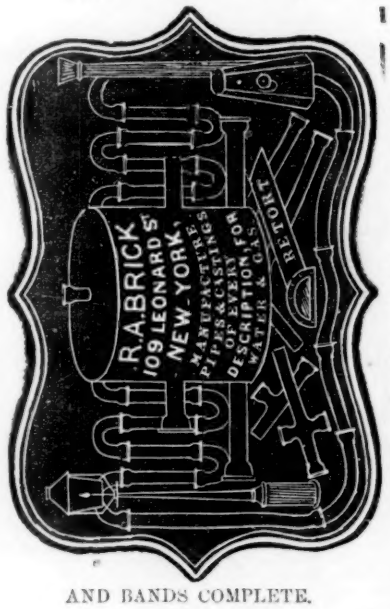

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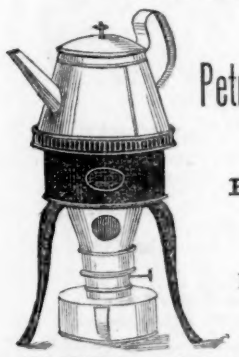

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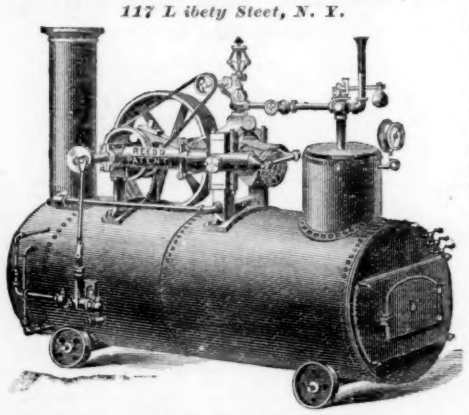

MANUFACTURERS OF

Slide & Oscillating, Stationary & Portable

ENGINES,

Of all sizes. Also furnish all kinds of MACHINERY, TOOLS, AND GENERAL SUPPLY. Drawings of all kinds of Machinery executed to order.

JOHN A. REED. [63-86] W. B. COGSWELL.

F. H. LOVELL & CO.,

Successors to Alfred Bliss & Co.

MANUFACTURER AND JOBBERS OF

KEROSENE

LAMPS

CHANDELIERS,

BRACKETS,

AND

Lamp Trimmings

GENERALLY.

Station, Sugar House, Street and Coal Oil Lanterns.

No. 233 Pearl Street,

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Illustrated catalogues and price lists furnished on application.

TURNBULL'S

AUTOMATIC PURIFIER.

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EDDY'S

Kerosene Cooking & Heating

STOVES AND RANGES.

THESE COOKING STOVES WILL

☞ *Bake, Boil, Stew, Fry and Roast,*

With the greatest economy and facility, and without heating the room in which they are used. They are perfectly simple, operating like an ordinary Kerosene Lamp with a chimney, and are the only Kerosene Stoves that burn without smoke or odor.

"We have been perfectly astonished to see what a labor-saving, dirt saving and heat-saving institution is EDDY'S PATENT KEROSENE STOVE. Taking the cost of running it, and the result attained, it is the best patent in the market."—*Worcester Daily Spy.*

Our Heating and Cooking Stoves are very convenient and economical, especially where a fire is required but a few hours at a time.

Orders for Stoves may be sent through American Advertising Agency, 389 Broadway, New York.

ALEX. M LESLEY,

Manufacturers, No. 605 Sixth Ave., New York.

Send for Illustrated Circular. (136

KNITTING MACHINES

FOR

Families and Manufacturer,

☞ *Something New and Invaluable for Family Use.*

We offer the public the simplest, strongest and best Knitting Machine in the world.

It occupies but little space—is portable and can be attached to a stand or table, weighs about 40 lbs.

It will knit a variety of Stitches—the breakage of needles is trifling—the cost of needles is insignificant and the most delicate material can be knit pure and spotless, as the needles are not oiled.

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Send for a Circular—Agents wanted.

DALTON KNITTING MACHINE CO.,

137] 537 Broadway, N. Y.

WEED'S

HIGHEST PREMIUM

Shuttle Sewing Machine

Has only to be seen and operated to be Appreciated.

Call and see for yourself before purchasing. Please bring samples of various kinds of thread, (such as is usually found at stores,) and various kinds of fabric, which you know the former most popular Sewing Machines either cannot work at all, or, at best very imperfectly.

SUPERIORITY.

over any other Machine in the market will be seen at a glance.

1st It runs easily and rapidly, and is so constructed as to endure all kinds of hard usage.

2d. No breaking of threads in going over seams.

3d. No imperfect action of the feed at uneven places in the work.

4th. The Weed-stitch catches of itself, and will sew from the finest lace to the heaviest leather, and 200 cotton to coarse linen thread.

5th. The Weed Machine will do beautiful quilting on the bare wadding, without using inner lining; thus leaving it soft as if done by hand.

6th. The variety of fancy work that can be done on the

WEED MACHINE,

with so little trouble, makes it equal, if not superior, to six machines combined; for instance. it Binds, Hems, Tucks and Sews on the band at the same time, and inf acc, the

WEED NO. 2 MACHINE,

as before stated, is equivalent to a combination of any six ordinary machines.

Orders for Machines may be sent through the American Advertising Agency 389 Broadway, N. Y.

Below we give a few prices:

No. 2. Oil Black Walnut, Ornamented with Hemmer.	$60,00
No. 2. Oil Black Walnut, Hall Case, Ornamented, with Hemmer.	65,00
No. 3. Extra Oil-Polished Black Walnut, Half Case, Large Table beautifully Ornamented.	75,00

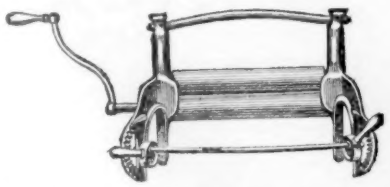
WEED SEWING MACHINE Co.,

136. 506 Broadway, New York

PUTNAM'S CLOTHES WRINGER.

IT IS THE ONLY RELIABLE

Self-Adjusting Wringer.



No Wood-work to Swell or Split. No Thumbscrews to get out of order. Warranted with or without Cog wheels.

It took the First Premium at Fifty-seven State and County Fairs in 1863, and nearly double that number in 1864, and is, without an exception, the *best* Wringer ever made. Patented in the United States, England, Canada, and Australia. Agents wanted in every town, and in all parts of the world. Energetic agents can make from $3 to $10 per day

WHAT EVERYBODY KNOWS, VIZ.:

That Iron well galvanized *will not rust.*

That a *simple* machine is better than a complicated one.

That a Wringer should be *self-adjusting, durable, and efficient.*

That thumb-screws and fastenings cause *delay* and *trouble* to regulate and keep in order.

That wood soaked in water will *swell, shrink,* and *split.*

That wood-bearings for the shaft to run in *will wear out.*

That the Putnam Wringer, with or without cog wheels, will *no tear the clothes.*

That cog-wheel regulators are not essential.

That the Putnam Wringer has *all* the advantages, and *not one* of the disadvantages above named.

That all who have tried it pronounce it the *best* Wringer ever made.

That it will wring a thread or a bed-quilt *without alteration.*

We might fill the paper with testimonials, but insert only a few to convince the skeptical, if such there be; and we say to all, *test* Putnam's Wringer. Test it *thoroughly* with *any* and any others, and if not entirely satisfactory, return it;

PUTNAM MANUFACTURING CO.—*Gentlemen:* I know from practical experience that iron well galvanized with zinc will not oxydize or rust one particle. The Putnam Wringer is as near perfect as possible, and I can cheerfully recommend it to be the best in use. Respectfully yours,

JOHN W. WHEELER, Cleveland, O.

Many years' experience in the galvanizing business enables me to indorse the above statement in *all particulars.*

JOHN C. LEFFERTS, No. 100 Beekman St.

NEW YORK, *January,* 1864.—We have tested Putnam's Clothes Wringer by practical working, and know that it will do. It is cheap; it is simple; it requires no room, whether at work or at rest; a child can operate it; it does its duty thoroughly; it saves time, and it saves wear and tear. We earnestly advise all who have *much* washing to do, with all intelligent persons who have *any,* to buy this Wringer. It will pay for itself in a year at most. HORACE GREELEY.

PRICES—$8, $9, and $10.

Sample Wringers sent, express paid, on receipt of price.

Manufactured and sold, wholesale and retail, by

PUTNAM MANUF'G CO.,

13 PLATT STREET, New York,

BENNINGTON, Vt.,

CLEVELAND O.

C. GEFRORER,

MANUFACTURER OF

Gas Heating Apparatus

OF EVERY DESCRIPTION,

Gas Burners, &c.

No. 529 COMMERCE STREET,

PHILADELPHIA, PA.

Burners for Wood, Coal Oil and Water Gas.

Gas and Lava Burner Tips

Constantly on Hand

THE AMERICAN METER CO.

Organized under the General Manufacturing Laws of the State of New York

SAMUEL DOWN, President. HENRY CARTWRIGHT, Vice President. RICHARD MERRIFIELD, Secretary and Treasurer

Trustees.

SAMUEL DOWN, WILLIAM HOPPER, R. H. GRATZ, HENRY CARTWRIGHT, RICHARD MERRIFIELD.
THOMAS C. HOPPER, *Superintendent at Philadelphia.*

This Company is now prepared to furnish WET AND DRY GAS METERS, STATION METERS, GOVERNORS, PRESSURE INDICATORS AND REGISTERS, SERVICE and METER COCKS, and all other articles in their line appertaining to the use of Gas-Works.

The combination of Mechanical and Scientific Skill, and the long experience of the several members of the Company, is a sure guarantee of durability, accuracy and excellence of workmanship. Orders addressed

AMERICAN METER COMPANY,

West Twenty Second Street, New York. Arch and Twenty-Second Streets, Philadelphia. No. 23 West Street, Boston will meet with prompt attention.

Harris & Brother, Practical Gas Meter Manufacturers,

Continue, as heretofore at their old Establishment, No. 1117 CHERRY ST., PHILADELPHIA, to Manufacture

WET AND DRY GAS METERS, and all kinds of GAS APPARATUS, and furnish all articles appertaining to the use of Gas Works. ☞OUR WORK WARRANTED—Satisfaction Guaranteed. Orders respectfully solicted, and promptly attended to, by

HARRIS & BRO., No 1117 Cherry st., Philadelphia.

Messrs. Harris & Brother, Philadelphia Gas Works, February 14. 1857.

Dear Sirs;—I take great pleasure in stating that we have found your meters to register with entire correctness, and to be generally of very good quality—the number furnished by you to these works is over 5,000.

JOHN C. CRESSON, Engineer;

Office of the Gas Light Company of Augusta, Ga., March 6th, 1858.

This is to certify that having used meters manufactured by Messrs. Harris & Bro., for the last nine years, we do not hesitate to state they have given entire satisfaction in point of wokmanship and accuracy of registration; they are surpassed by none, and equaled by few manufactories in the Union; we have used meters made by other establishments but our preference is in favor of those made by Harris & Bro., of Philadelphia, Pa.

G. S. HOOKEY, Superintendent of the Gas Light Company of Augusta, Georgia.

Messrs. Harris & Brother, Philadelphia. Philadelphia, March 4, 1858.

Gentlemen—We take great pleasure in bearing our testimony to the very superior character of the meters we have received from your establishment. We have always found the workmanship all we could desire, while the accuracy and reliability of their measurement have always been satisfactory. We have used meters made by other parties, and none have given as entire satisfaction as those received from you. We are, gentlemen, very truly, yours, BIRKINBINE & MEARS.

Messrs. Harris & Brother. March 14, 1857.

Gentlemen—For the last ten years we have used in the Philadelphia Gas Works, meters made in your factory, and take pleasure in expressing my opinion to their correctness. On several occasions I have taken your meters apart, and found the material used in the manufacture of the same, to be as fine quality as is used in those imported from Europe, or made by any of the manufactur in the United States. Respectfully Yours GEORGE WIEGAND, Inspector of Gas Fittings, Philadelphia

C. GEFRORER,

MANUFACTURER OF GAS BURNERS,

529 Commerce Street, Philadelphia, Pa.

Burners for Wood, Coal Oil, and Water Gas. Brass and Lava Burner Tips Constantly on Hand.

GROVESTEIN & CO.,

PIANO FORTE MANUFACTURERS,

499 BROADWAY, NEW YORK.

THE ATTENTION of the public and the trade is invited to our New Scale, Seven Octave, Rosewood Piano Fortes, which for volume and purity of tone are unrivalled by any that have hitherto offered in this market. They contain all the modern improvements, French Grand Action, Harp Pedal, Iron Frame, Over-strung Bass, etc., and each instrument, being made under the supervision of Mr. J. H. Grovesteen, who has had a practical experience of over thirty years in their manufacture, is fully warranted in every particular.

THE "GROVESTEEN PIANO-FORTE"
RECEIVED THE HIGHEST PREMIUM AT THE
CELEBRATED WORLD'S FAIR.

Where were exhibited instruments from the best makers of London, Paris, Germany, Philadelphia, Baltimore, Boston, and New York; and also at the American Institute for five successive years, the gold and silver medals from both of which can be seen at our warerooms.

By the introduction of improvement we make a still more perfect Piano-Forte, and by manufacturing largely, with a strictly cash system, are enabled to offer these instruments at a price which will preclude all competition.

PRICES

No. 1,	Seven Octave,	round	corners,	Rosewood, Plain Case, $300
No. 2,	"	"	"	Heavy Moulding 325
No. 3,	"	"	"	Louis XIV style 350

a fac-simile of the accompanying cut.

TERMS—Net Cash, in current funds Descriptive circular sent free on application.

THE AUBIN BALLANCED

VALVE WATER METER,

(Used also for Oils and Liquors)

Is now in use by many City Water Cos., because of its low price, simplicity, durability, accuracy under any pressure, and (a great advantage) because it runs with less head than any meter used. Manufactured by H. Q. HAWLEY, Albany, N. Y.

MORRIS, TASKER & CO.,

PASCAL IRON WORKS

[ESTABLISHED 1821,]

PHILADELPHIA,

Manufacture Wrought Iron Welded Tubes for Gas, Steam or Water; Lap-Welded Boiler Flues, GALVANIZED WROUGHT IRON TUBES,

ARTESIAN WELL PIPES,

of Wrought or Cast-Iron, screwed together, flush inside and out; Gas-works Castings, Retorts and Bench Castings for Coal Gas-works,; Cast-Iron Street Mains, Bends, Branches, Drips, &c.

Gas and Steam Fitters' Tools, &c.

STEPHEN MORRIS,
THOMAS S. TASKER,
CHAS. WHEELER,
STEPHEN M. P. TASKER.

J. VAUGHAN MERRICK, W. H. MERRICK,
JOHN E. COPE.

SOUTHWARK FOUNDRY,

FIFTH & WASHINGTON STREETS,

PHILADELPHIA.

MERRICK & SONS, Engineers,

MANUFACTURERS OF EVERY DESCRIPTION OF GAS MACHINERY.

Retorts, Bench Castings, Condensers, Washers, Scrubbers, Wet or Dry Lime Purifiers, Coke Wagons, Fire Tools, Wrought Iron Grate Bars, Gasholders, either Telescopic or Single, with Suspension Frames complete; Wrought Iron Roof Frames, for Iron or Slate; Stop Cocks, Exhausters, Steam Pumps, Boilers and Tanks, Steam or Hand Air Pumps for proving Street Mains, Centre Seals, Governors, Wrought or Cast-Iron, Line Sieves for Purifiers, Hoisting Machines for Lifting Purifier Covers.

Address— MERRICK & SONS,
5th and Washington Sts, Philadelphia.

S. FULTON & CO.,

(Successors to Colwell & Co.)

Manufacturers of

PIG IRON & CAST IRON GAS & WATER PIPES.

Also, Heavy & Light Castings of every description, No. 207 North Water street and 206 North Wharves, Philadelphia.

SAMUEL FULTON, THEO. TREWENDT

TO GAS COMPANIES.

THE UNDERSIGNED DESIRES TO undertake the supervision of several small Gas-works, to visit and examine them as often as may be necessary; to obtain and inspect their coal, castings, fire-brick, and other materials; and to manage their general business in such a manner that they shall be under such supervision as is now attainable in large works, at much increased cost. Also, to advise as general Consulting Engineer and expert in practical chemistry.

CHAS. M. CRESSON,
Late Asst. Engineer of the Philadelphia Gas-works
417 Walnut st., Philadelphia.

GEO. H. KITCHEN & CO.,

NEW PATENT

GAS APPARATUS

For Country Residences, Public Buildings, &c.,

FROM $300 UPWARDS.

EVERY DESCRIPTION OF GAS FIXTURES.

Gas Fitting in all its bauches

561 Broadway,
NEW YORK.

THE WOODWARD Steam Pump Manufacturing Company,

MNUFACTURERS OF THE WOODWARD PATENT IMPROVED

SAFETY STEAM PUMP,

—Adapted for Mining and Fire Purposes—and

Steam, Water & Gas Fittings of All Kinds.

Also, Wholesale and Retail Dealers in WROUGHT IRON PIPE, BOILER TUBES, etc.,

Woodward Building, 76 and 78 Centre Street,

corner of Worth street, Formerly 77 Beekman Street. *New York.*

53 GEO. M. WDDOWARD, Pres't. 64

JOSEPH LENNIG,

1615, 1617, and 1619 Francis St.,

Above Ridge Avenue, Philadelphia, Pa.,

MANUFACTURER OF

Wet and Dry Gas Meters,

STATION, SHOW, & EXPERIMENTAL METERS,

Photometers, Pressure Registers, Indicators, and Gauges, Governors, Meter Provers, Centre Seals, Fluid Gauges, &c.

GAS APPARATUS

Of the most reliable and approved construction manufactured and on hand at the

UNION GAS METER WORKS.

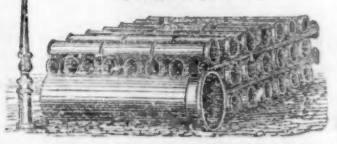
R. D. WOOD & CO.,

MANUFACTURERS OF

CAST-IRON PIPE, RETORTS, &c.

Office, 400 Chestnut Street,

PHILADELPHIA.



FINKLE & LYON'S

New Family

SEWING MACHINE

Should be known in

IN EVERY TOWN.

To accomplish this at once and save the expense of a *Travelling Agent*, we offer thus, viz:

Any one sending us orders for two machines shall receive one machine free of charge. This proposition cannot avail after we have appointed a local agent in the town.

We have now completed our *new manufacture* at a cost of some $200,000—introducing *new patents*, and such important improvements, that without fear we are able to offer the following stringent guarantee, viz: After a fair trial, if any purchaser does not prefer the FINKLE & LYON FAMILY SEWING MACHINE to any other, he can return it and have back his money.

This machine has taken many of the HIGHEST PRIZES; *is less complicated than any other first class machine; does a wider range of work without changing; requires no taking apart to clean or oil, no "lessons" to set needle, regulate tension or operate machine.*

Our new Manufacturing Machine is sold on the same terms as the Family Machine.

Please send for a circular with samples of sewing.

Finkle & Lyon S. M. Co.

No. 561 BROADWAY, NEW YORK.

Great Improvement

IN

Sewing Machines.

EMPIRE

SHUTTLE MACHINE!

Patented February 14th, 1860.

Salsroom, 536 Broadway.

This Machine is constructed on entirely new principles of mechanism, possessing many rare and valuable improvements, having been examined by the most profound experts, and pronounced to be SIMPLICITY and PERFECTION COMBINED.

It has a straight needle, perpendicular action, makes the LOCK or SHUTTLE STITCH, which will NEITHER RIP nor RAVEL, and is alike on both sides; performs perfect sewing on every description of material, from Leather to the finest Nansook Muslin, with cotton, linen, or silk thread, from the coarsest to the finest numbers.

Having neither CAM nor COG WHEEL, and the least possible friction, it runs as smooth as glass, and is

Emphatically a Noiseless Machine!

PRICE OF MACHINES,

COMPLETE:

No. 1, Family Machine, with Hemmer, Feller, Gauge, Braider, & Corder, complete. - - - $60
No. 2. Small Manufacturing, with Extension Table, $75
No. 3. Large Manufacturing, with Extension Table, $85
No 3. Large Manufacturing, for Leather, with Rolling Foot and Oil Cup, 100

One-half hour's instructions is sufficient to enable any person to work this Machine to their entire satisfaction.

Agents Wanted in all Towns in the United States, where Agents are not already established. Also, for Cuba, Mexico, Central and South America, to whom a liberal discount will be given Terms, invariably CASH on delivery.

T. J. McARTHUR & CO.,

536 Broadway.

GAS-BURNERS.

WIGHTMAN BROS.,

IMPORTERS AND

SOLE AGENTS

For the United States and Canada, of

SCHWARZ'S

GERMAN LAVA GAS-TIPS

And proprietors of Winchester's Improved

LAVA TIP GAS BURNERS,

No. 25 Kilby Street,

BOSTON, MASS.

T. G. ARNOLD,

MANUFACTURER OF

GAS-BURNERS,

And Importer of SCOTCH TIPS,

336 and 338 West 21st street,
formerly No. 447 BROOME ST.,
New York.

Mercury Cups, Portable Sockets, Burner Pillars, Burner Pliers, &c., &c.

C. GEFRORER,

Manufacturer of

GAS-BURNERS,

For Lighting and Heating Purposes.

GAS HEATING AND COOKING APPARATUS; FITTERS' ROVING APPARATUS, &c.

529 Commerce st., bet. Market & Arch, Philadelphia

JOSEPH LEES,

Sole Agent for the sale of

Thompson's Gas Controller

In the States of

CALIFORNIA AND OREGON,

San Francisco, Cal.

The Electric Light Machine.

The following, taken from the British *Journal of Photography*, describes the new electric machine of Prof. Wheatstone.

"Our ideas of the electric light are almost invariably associated with the recollections of trouble and difficulty often experienced in the management of a large galvanic battery, with its accompanying fittings, acids, and fumes, detrimental alike to the clothes, hands and olfactory organs of the operator. How different it would be if, instead of the cumbrous paraphernalia, we had but to turn a wheel and lo! our sun would send forth his brilliant beams! This is not now a mere matter of theoretical speculation, but is really *un fait accompli.*

"In the new machine no magnetism, no electricity, is required to commence the action. Nothing but motion is needed to convert a mass of iron and covered wire into a magazine of intense electric power.

"The new machine consists essentially of a bar of iron bent in horse-shoe fashion; around this is coiled covered wire as in an ordinary electro-magnet. Between the poles revolves a spindle carrying covered wire, insulated, but so arranged that either end will be alternately brought into contact with each terminal of the wire surrounding the iron bar. Again the spindle is so placed that during its revolution on its long axis, it is made to present each side in succession to either limb of the horse-shoe. The spindle is driven by an endless band, which passes around the circumference of a tolerably large fly-wheel. This is the general construction. When the spindle is rapidly revolved the horse-shoe becomes magnetized, a powerful electric current being induced in the wire helix at the same time; and as the motion is continued, the forces go on acting and reacting until a very high degree of intensity is obtained. The electricity can be taken between two terminals placed in proper position. In this respect an important point of difference exists between Mr. Wilde's machine and Prof. Wheatstone's, inasmuch as in the former anybody who we wish to submit to the action of the electric current must form the terminals of the complete circuit, whereas in the new apparatus the substance to be operated upon forms a bridge or short-cut for the electricity, in order to complete the circuit.

"The power of this apparatus is so great that, even when of small size and easily turned by the hand, it is capable of burning a piece of iron thirty inches long and one-sixteenth of more in diameter. In this experiment, at the moment of separatian of the fused and glowing iron, the metal scintillates in a very beautiful manner. The same result is also obtained by approaching one terminal, consisting of iron wire, to the second end; the iron immediately takes fire and burns with brilliant corruscation. When the current is made to pass between charcoal points a beautiful and steady light is obtained. This is the point which chiefly interests us, and we have little doubt that before long we shall have a machine which will be practicably available, and enable us to realize the idea conveyed in the term "turning on the sun" whenever we need additional light."

Stewart's Patent Perforated Wrought Iron Tile.

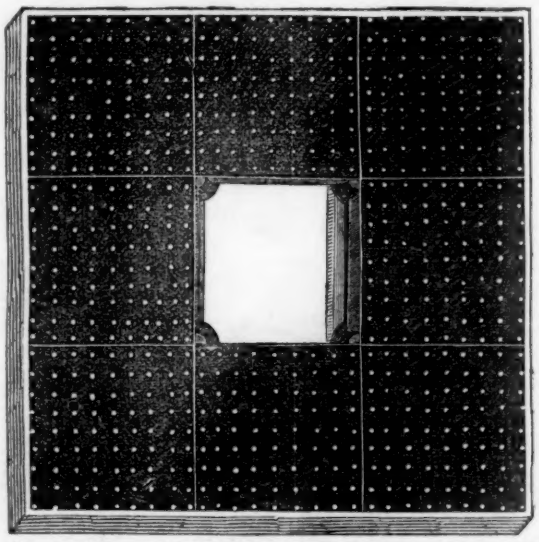
Iron is being substituted to a very great extent at the present time for materials which, a few years ago, we considered impossible to replace by any such costly article. The shingle and tile roofs of our buildings are replaced by galvinized iron. The frame work of wood gives place to the light, strong and ornamental iron work; even the entire exterior is frequently an armor of iron far more strong, durable and tasteful, and in the end cheaper than wood and, in many situations, more appropriate than stone, marble, or brick.

This may be called the "iron age" when we find it composes the houses we inhabit, the ships we sail in, the bridges that span our broadest rivers, and the pavements of our cities.

The Stewart perforated wrought iron tile is another place where it has asserted its supremacy instead of brick. The accompanying engraving gives an idea of its construction. The sheet iron is perforated as shown, and placed in a press which turns up the four sides at right angles about two inches, making a quadrangular pan with a perforated bottom. A frame work is provided with short upright studs, slotted to let the corners of each tile slip in to hold it firmly to its place as fully shown in the cut. In this manner a flooring can be quickly laid and each tile can be readily replaced if necessary at little expense. The turned edges of the tile being underneath, give it great strength and allows it to be made of much thinner iron than it could be otherwise. The tiles are made to conform in shape and size to the brick tile, so it can readily replace the brick tile without any alteration in the supports or foundation. This tile is said to have all the strength and firmness of a brick floor for malt kilns, and the perforations never become clogged, and it makes a uniform, smooth surface over the entire area of the floor, and it is more economical.

As a means for ventilation or for the introduction of hot air from heaters to warm buildings, this tile must become popular; but for malt kilns and drying floors it has already obtained a valuable reputation.

T. G. Arnold, 336 and 338 West Twenty-first street, New York, manufactures these tiles, and will supply further information.



STEWART'S PERFORATED WROUGHT IRON TILE.

The Fire Extinguisher in California.

A trial of Levey's Fire Extinguisher was made last night (Tuesday, July 9), in Union Square, before a crowd of some two or three thousand persons. The machine itself is a tin can, capable of holding about four gallons. It is filled with water, into which is introduced certain chemical substances which create a kind of gas. The machine can stand charged for years. The gas, by turning a cock, is ejected through a hose on to the fire, at a distance of forty feet, if necessary, the operator holding the can on his back, where it is fastened by shoulder straps. The trial was made under the supervision of some of the Fire Commissioners, the Fire Marshal, ex-Chief Scannell, Superintendent of Streets, and others. A redwood building, twelve by twelve, was erected. In this was placed several large tar barrels, well saturated with tar and filled with shavings. The fire was to the pile, and when it had become well heated and the flames were bursting through all sides of the house, the judges gave the word to Levey to "play away." He did so, and in one minute he had the flames under control. The tar barrels were then allowed to heat up again, and in less than a minute the fire was put out, except a few coals and cinders. The trial was very satisfactory to all present, and demonstrated the capacity of the machine to do all that is claimed for it. With one of the extinguishers in a house a fire could never get full headway, for it could be extinguished in less time than it would take to give the alarm for the Department. Mr. Levey is an old Californian, and he offers to Californians about the best thing yet discovered for preventing conflagrations.—*San Francisco Daily Call.*

How to Use Peat.

It should be borne in mind that peats differ in quality and characteristics, and, consequently, in their heating properties and value, full as much as wood and coal in all their varieties; and that the results obtained from peat fuel, as from any other, will, in all cases, depend very much upon the manner in which it is burned.

We are told that a certain service is obtained from a boiler, with one cord of wood or one ton of coal; but unless we know whether the wood be pine or hickory, or the coal Pictou or Lehigh, we have no certain data from which to make accurate or even approximate calculations; so also of peat, it is necessary to know somewhat of its characteristics in each case reported in order to form a correct estimate of its relative value for the service done. The terms by which to designate these characteristics and qualities, so as to be generally understood and adopted, have yet to be determined upon; but the necessities of the case will doubtless bring them out in good time.

That peat is a *good* fuel is universally conceded, which is more than was even admitted for coal when it was first introduced. The important questions now are as to the arrangements of furnaces, grates, drafts, etc., and the manner of using the fuel to the best advantage—in other words, "the people" have to learn *how to use it;* but the task is an easy one.

We have before stated that our own experience has taught us, that, as a general thing, peat fuel should be burned in smaller area and bulk than coal, but renewed in small quantities somewhat more frequently, and with very much less draft. The heat is clear and intense. The quantity of kindling wood required is very small. —*Leavitt's Peat Journal.*

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